

# WORK OR WORKOUT? A COMPARISON OF OCCUPATIONAL AND RECREATIONAL PHYSICAL ACTIVITY IN RELATION TO HEALTH

MING-YEN WANG<sup>1</sup>

LI-SHIUE GAU<sup>1</sup>

KUAN-CHIEH WANG<sup>1</sup>

SUMAN KUMAR<sup>1</sup>

ANKITA MANOHAR WALAWALKAR<sup>1\*</sup>

<sup>1</sup> DEPARTMENT OF BUSINESS ADMINISTRATION, ASIA UNIVERSITY, TAIWAN

KEDAR SINGH NEGI<sup>2</sup>

<sup>2</sup> MAHATMA GANDHI INSTITUTE OF HEALTH INFORMATICS, MGUMST, JAIPUR, INDIA

\*Corresponding Author Email: [ankitamw@ieec.org](mailto:ankitamw@ieec.org)

**Abstract:** The purpose of this study is to examine and compare the health benefits derived from recreational exercise and work-related physical labour. The research adopts a secondary data analysis approach, using data obtained from the "2002 Taiwan National Health Promotion Knowledge, Attitude, and Behaviour Survey" conducted by the Health Promotion Administration, Ministry of Health and Welfare. The survey targeted Taiwanese citizens aged 15 and above across all counties and cities, with a total sample size of 26,755 respondents. The dataset includes information on daily lifestyle behaviours, exercise habits, occupational activities, self-rated health, and depression scale scores. Data analysis was performed using SPSS for Windows, version 12.0.

The results reveal that the average age of participants in the recreational exercise group was 32.94 years (SD = 19.30), while that of the work-related physical labour group was 54.67 years (SD = 12.93). After excluding individuals who smoke, drink alcohol, or chew betel nuts, no significant difference in depression levels was observed between the two groups. One-way ANOVA controlling for age indicated that, compared with the work-related physical labour group, the recreational exercise group reported a higher incidence of age-related health problems such as hypertension, hyperlipidaemia, heart disease, stroke, diabetes, asthma, kidney disease, and osteoporosis. However, no significant difference was found between the two groups in self-perceived health status.

**Keywords:** Recreational exercise, Work-related physical labour, Sedentary lifestyle, Health, Physical activity, Leisure time

## INTRODUCTION

In recent years, rapid advancements in the economy and technology have profoundly transformed human lifestyles. Manual production, once dependent on human labour, has gradually been replaced by mechanised systems, while the continuous emergence of high-tech products has improved both the quality and convenience of life (Shen & Zhou, 2024; Szeszák et al., 2025). However, technological progress is often a double-edged sword. As human society transitioned from agricultural and hunting-based livelihoods to modern industrial and commercial societies, the most significant change has been the rise of the sedentary lifestyle (Anim et al., 2025). While modern conveniences have enhanced daily comfort, they have also drastically reduced opportunities for physical activity (Hanna et al., 2023).

Physical inactivity remains a significant concern in Taiwan and worldwide. National surveys by the Directorate-General of Budget, Accounting and Statistics reported that only about 39% of Taiwanese citizens aged 15 and above engage in regular exercise (Chang & Wu, 2023). Although the proportion of people exercising at least three times per week increased from around 13% in 2003 to 30% in 2012, more than two-thirds of the population still lack consistent physical activity (Sullivan & Lachman, 2017). Similar global trends have been observed. The World Health Organisation estimates that between 60% and 85% of adults worldwide lead sedentary lifestyles, which significantly increases the risk of cardiovascular disease, obesity, diabetes, and premature mortality (Park et al., 2020). In Taiwan, chronic illnesses related to inactivity, such as heart disease, cancer, and hypertension, now represent the major causes of death. These findings emphasise the urgent need to encourage active living as a key strategy to enhance national health and reduce healthcare burdens (Chao et al., 2024).

A review of prior studies reveals extensive research on physical activity. For example, Abdullah et al., (2025) studied elderly women and found that those with higher activity levels showed better agility, balance, and cardiopulmonary fitness than those with lower levels. Kohl III (2013) found that high school students engaging

in vigorous physical activity demonstrated superior fitness compared to their less active peers. Likewise, Lo (2017) observed that among Taipei junior high students, higher levels of moderate-to-vigorous activity were positively correlated with long-jump and sit-up performance, but negatively correlated with body mass index (BMI), indicating that less active students had poorer physical fitness.

Moreover, research indicates that moderate-to-high-intensity occupational or leisure activities can reduce the risk of cardiovascular disease and hypertension in both men and women (Kazemi et al., 2024). Similar studies suggest that combining physical activity from work, household chores, and leisure can help prevent premature death (Autenrieth et al., 2011; Coenen et al., 2024). Research has shown that engaging in at least 30 minutes of moderate-intensity exercise most days of the week can significantly reduce the risk of developing conditions such as cardiovascular disease, type 2 diabetes, and certain types of cancer (Tian & Meng, 2019; WHO, 2024).

Recreational exercise is widely recognised for its positive effects on physical and mental health (Mahindru et al., 2023). Studies have shown that regular leisure activities enhance cardiovascular function, muscle strength, coordination, and overall metabolism, while reducing stress and promoting psychological well-being (Pinckard et al., 2019). However, research on the health effects of occupational physical labour remains limited. Many rural areas of Taiwan involve high levels of daily physical activity that may offer similar benefits to structured exercise (Cillekens et al., 2022). This study, therefore, aims to compare the health outcomes of recreational exercise and work-related physical activity using secondary data. Understanding these differences can guide how rural regions develop "green exercise capital," emphasising the preservation of natural environments rather than constructing additional sports facilities that may not align with residents' lifestyles.

This study is based on secondary data collected from a nationwide survey of citizens aged fifteen and above. Since the dataset was not specifically designed to represent individuals engaged in physically demanding work or regular recreational exercise, its ability to capture the characteristics of these groups may be limited. The available classifications of exercise behaviour, regular, occasional, light, seldom, or no exercise, also restrict the depth of analysis. Moreover, exercise intensity was assessed subjectively, based on respondents' perceptions of breathing difficulty and sweating, rather than through objective measures such as oxygen consumption. Adopting standardised physiological indicators or a more comprehensive theoretical model could yield more accurate insights. Additionally, the dataset did not account for other factors such as social support or psychological well-being, which may also influence health outcomes (Biswas et al., 2025; Su et al., 2025). Therefore, while the study focuses on physical activity through work and leisure, these should be understood as part of a broader framework affecting overall health.

Building on the research motivation outlined earlier, this study aims to achieve three key objectives. First, it examines whether occupational differences exist between individuals who engage in regular leisure-time exercise and those who are physically inactive. Second, it examines whether individuals in physically demanding jobs are less likely to engage in additional exercise during their free time. Third, it examines whether the physiological and psychological benefits of leisure-time exercise differ significantly from those derived from work-related physical labour, after accounting for factors such as smoking, alcohol consumption, and betel nut use.

Overall, this study aims to provide a deeper understanding of how various forms of physical activity, including both occupational and recreational activities, contribute to overall health and well-being. By comparing exercise habits across occupational groups, the findings aim to inform strategies that promote healthier lifestyles and support the design of effective public health and community fitness initiatives, particularly within rural populations.

## RESEARCH METHODOLOGY

Based on the objectives of this study and the findings summarised from the literature review, the research framework is proposed as shown in Figure 1. In this framework, physical activities, including leisure-time exercise and work-related physical labour, are identified as independent variables, while physiological and psychological benefits serve as the dependent variables. Factors such as age, smoking, drinking, and betel nut chewing are included as control variables.

### Data Sources

With Taiwan's demographic transition characterised by a declining birth rate and an ageing population, patterns of disease have also undergone significant shifts. Changes in lifestyle and dietary habits, such as reduced physical activity, high-fat diets, and the rising prevalence of smoking and betel nut chewing among men, have contributed to an increase in chronic conditions. In addition, many citizens lack sufficient awareness about cancer prevention and screening, often turning to folk remedies instead of seeking timely medical treatment, which delays care and increases the overall social and healthcare burden.

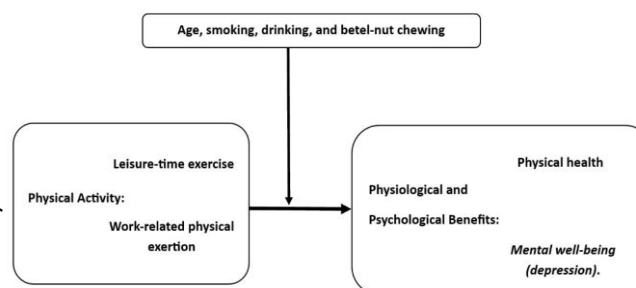


Figure 1: Research Framework

At present, non-communicable diseases (NCDs) such as cancer, cardiovascular disease, cerebrovascular disease, and diabetes remain the leading causes of death in Taiwan. To effectively encourage the public to adopt healthy behaviours and prevent disease, it is essential to first understand citizens' knowledge, attitudes, and behaviours related to health promotion, as well as the factors influencing health-risk behaviours.

To ensure comprehensive and representative data on citizens' health behaviours, the Health Promotion Administration (HPA) and its affiliated research teams developed a nationwide survey on health knowledge, attitudes, and practices among individuals aged 15 and above across Taiwan. The study adopted a stratified, multistage systematic random sampling method, using household registration records as the sampling framework. Each county and city served as an independent stratum, from which townships, neighbourhoods (li), and individual respondents were randomly selected in successive stages to maintain regional representativeness.

For large metropolitan areas such as Taipei and Kaohsiung, a slightly modified two-stage sampling design was applied to account for population density and administrative divisions. To correct for varying sampling probabilities and ensure accurate national estimates, appropriate weighting adjustments were performed during data analysis.

The dataset utilised in this study originates from a nationally representative health survey conducted under the guidance of the Health Promotion Administration, Ministry of Health and Welfare. The survey was designed to address previous limitations in health behaviour research by enhancing data reliability, improving coverage across population subgroups, and aligning the findings more closely with the needs of public health policy. The survey was conducted between October 2002 and March 2003, encompassing all regions of Taiwan, and yielded a total of 26,755 valid samples.

### Description of Questionnaire Items

This study utilises secondary data from a nationwide health behaviour survey conducted by the Health Promotion Administration (HPA), Ministry of Health and Welfare. The dataset includes variables covering sedentary time, exercise habits, occupational activity, health-related factors, and perceived health benefits.

#### a. leisure time

Sedentary behaviour was measured through a self-reported question designed to capture the average duration of low-activity sitting time during a typical day. Participants were asked:

"On average, excluding sleep, how many hours per day do you spend sitting with minimal physical movement, including activities such as working, studying, reading, watching television, using the computer, or doing homework?"

Respondents reported the total number of hours spent per day in sedentary activities. This measure reflects the cumulative non-active time across work and leisure contexts, serving as an important indicator of lifestyle patterns and potential health risks.

#### b. Exercise

The level of physical activity was measured through questions assessing occupational exertion and regular exercise behaviour, as shown in **Table 1**. It is explained in detail.

| Item                                    | Question                                                                   | Response Options                                                                                                          | Measurement Purpose                                                     |
|-----------------------------------------|----------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| <b>1. Occupational Physical Demand</b>  | Would you say that your daily activities or work are physically demanding? | 1 = Very physically demanding<br>2 = Somewhat physically demanding<br>3 = Not physically demanding                        | Assesses intensity of physical exertion during work or daily activities |
| <b>2. Regular Exercise Behaviour</b>    | Do you usually engage in exercise?                                         | 1 = Yes    2 = No                                                                                                         | Identifies engagement in intentional physical activity                  |
| <b>3. Exercise Frequency</b>            | On average, how many times per week do you exercise?                       | (1) Less than once<br>(2) 1–2 times<br>(3) 3–4 times<br>(4) 5–6 times<br>(5) 7 times or more<br>(6) Not fixed / irregular | Measures the frequency of exercise participation                        |
| <b>4. Exercise Duration</b>             | On average, how long do you exercise each time?                            | Open-ended (minutes)                                                                                                      | Measures duration per exercise session                                  |
| <b>5. Exercise Intensity (Sweating)</b> | Do you usually sweat when you exercise?                                    | (1) No sweating (light intensity)<br>(2) Sweat a little (moderate intensity)<br>(3) Sweat a lot (vigorous intensity)      | Subjective indicator of exercise intensity                              |

|                                          |                                                      |                                                                                                                                                                                                                                                                            |                                                        |
|------------------------------------------|------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------|
| <b>6. Exercise Intensity (Breathing)</b> | Do you usually feel short of breath when exercising? | (1) No<br>(2) Slightly faster breathing<br>(3) Somewhat breathless<br>(4) Out of breath / gasping for air                                                                                                                                                                  | An additional subjective measure of exercise intensity |
| <b>7. Reasons for Not Exercising</b>     | Why do you not engage in exercise?                   | (1) Environmental – Lack of facilities<br>(2) Time constraints<br>(3) Social – No companion<br>(4) Family responsibilities<br>(5) Health issues<br>(6) Physical fatigue<br>(7) Lack of motivation<br>(8) Nature of work – Already physically active<br>(9) Other (specify) | Identifies barriers to regular exercise participation  |

**Table 1. Measurement Items for Exercise Behaviour**

**c. Work**

This section utilises Question A6 from the original survey, which inquires about respondents' current employment status. For the purposes of this study, responses were coded to prioritise those engaged in labour-intensive occupations. Below in Table 2, all the questions are mentioned in detail.

| Item                         | Question                     | Response Options                                                                                                                                                                                                                                                                                                                        | Measurement Purpose                                         |
|------------------------------|------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------|
| <b>1. Employment Status</b>  | Do you currently have a job? | (1) Yes, currently employed<br>(2) No, not employed                                                                                                                                                                                                                                                                                     | Identifies the respondent's employment status               |
| <b>2. Type of Occupation</b> | What kind of work do you do? | a. Agriculture, Forestry, Fishing, Animal Husbandry, or Hunting<br>b. Manufacturing, Mining, Construction, or Public Utilities,<br>c. Commerce / Business Sector<br>d. Transportation and Communications (e.g., highway, railway, postal services, telecommunications)<br>e. Personal Service Industry<br>06. Government Service Sector | Classifies respondents by industry or occupational category |

**Table 2. Measurement Items for Work**

**d. Health-Influencing Factors**

This section utilises the following items from the original questionnaire:

A1 (Age), D4 (Smoking), D32 (Betel Nut Chewing), and D38 (Alcohol Consumption). Details mentioned in Table 3.

| Item                        | Question                                                                       | Response Options                                                                                                                                                                                                                                                                                       | Measurement Purpose                                       |
|-----------------------------|--------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------|
| <b>1. Age</b>               | What is your date of birth? (Please use the Gregorian calendar)                | (1) Before the founding of the Republic of China<br>(2) Born in the Republic of China era<br>Year / Month / Day: _____                                                                                                                                                                                 | Determines the respondent's age and cohort classification |
| <b>2. Smoking Behavior</b>  | Have you ever smoked in your lifetime?                                         | (1) Yes, (2) I have never smoked                                                                                                                                                                                                                                                                       | Assesses smoking habits as a health-related risk factor   |
| <b>3. Betel Nut Chewing</b> | Have you ever chewed betel nut? (If yes, are you currently chewing betel nut?) | (1) No, I have never chewed betel nut<br>(2) Yes, I have chewed only 1–2 times in the past<br>(3) Yes, I currently chew (including those who have chewed within the past six months)<br>(4) Yes, I used to chew but no longer do (no chewing within the past six months); Quit in: _____ Year<br>Month | Evaluates consumption of betel nut and cessation patterns |

|                               |                                                      |                |                                                             |
|-------------------------------|------------------------------------------------------|----------------|-------------------------------------------------------------|
| <b>4. Alcohol Consumption</b> | Do you currently have the habit of drinking alcohol? | (1) Yes (2) No | Identifies alcohol use as a lifestyle-related health factor |
|-------------------------------|------------------------------------------------------|----------------|-------------------------------------------------------------|

**Table 3. Measurement Items for Health-Influencing Factors**

**e. Health Benefits**

This section uses the following items from the original questionnaire which are mentioned below in Table 4: B1 (Current Health Status), B3 (Hypertension), B5 (Heart Disease), B7 (Diabetes), B11 (Osteoporosis), B20 and B21 (Activity Limitations), and D39 (Depressive Symptoms) the latter based on the TDQ Scale developed by the John Tung Foundation.

| Item                             | Question                                                                                                                                                          | Response Options / Scale                                                                                                                                                         | Measurement Purpose                                                                                                                                                    |
|----------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>1. Self-Rated Health</b>      | In general, how would you rate your current health status?                                                                                                        | 1 = Very good<br>2 = Good<br>3 = Fair<br>4 = Poor<br>5 = Very poor                                                                                                               | Assesses overall perception of health                                                                                                                                  |
| <b>2. Hypertension Diagnosis</b> | Have you ever been diagnosed with hypertension (high blood pressure)?                                                                                             | 1 = Yes<br>2 = No<br>3 = Don't know                                                                                                                                              | Captures cardiovascular-related health condition                                                                                                                       |
| <b>3. Heart Disease</b>          | Do you currently have heart disease?                                                                                                                              | 1 = Yes<br>2 = No<br>3 = Don't know                                                                                                                                              | Captures presence of cardiovascular disease                                                                                                                            |
| <b>4. Diabetes</b>               | Do you have diabetes?                                                                                                                                             | 1 = Yes 2 = No 3 = Don't know                                                                                                                                                    | Captures metabolic health condition                                                                                                                                    |
| <b>5. Osteoporosis</b>           | Have you been diagnosed with osteoporosis?                                                                                                                        | 1 = Yes 2 = No 3 = Don't know                                                                                                                                                    | Captures bone health status                                                                                                                                            |
| <b>6. Functional Ability</b>     | Do you experience difficulty performing daily activities (e.g., sweeping, washing dishes, cooking, bathing, dressing, eating, walking indoors, using the toilet)? | 0 = No difficulty<br>1 = Some difficulty<br>2 = Great difficulty<br>3 = Completely unable                                                                                        | Measures physical functional limitations in daily life                                                                                                                 |
| <b>7. Depressive Symptoms</b>    | During the past week, how often have you experienced mood changes or depressive symptoms? (TDQ – Taiwan Depression Questionnaire)                                 | 0 = None or rarely (<1 day)<br>1 = Occasionally (1–2 days)<br>2 = Frequently (3–4 days)<br>3 = Often/always (5–7 days)<br>4 = Other<br>8 = Not applicable 9 = Unknown/ unanswerd | Assesses mental health and depressive tendency. Total scores: 0–8 = emotionally stable, 9–14 = mild fluctuations, 15–18 = near threshold, ≥19 = severe depressive mood |

**Table 4. Measurement Items for Health Benefits**

**Data Analysis Methods**

Data analysis for this study was conducted using the Chinese version of SPSS for Windows 12.0. The analyses were aligned with the research objectives to ensure accurate and meaningful results. The study sample included 26,755 valid respondents, representing Taiwanese nationals aged 15 and older from all counties and cities across Taiwan. Descriptive statistics were first calculated to examine the distribution of key variables such as gender, age, educational level, occupation, exercise behaviour, and depressive symptoms. Frequency counts, percentages, means, and standard deviations were used to provide a clear overview of the sample characteristics and variable distributions. Additionally, a one-way analysis of variance (ANOVA) was conducted to examine the relationships between demographic and behavioural factors, such as age, smoking, alcohol consumption, and betel nut chewing and their impact on physical health outcomes. This approach allowed for a comprehensive understanding of how lifestyle and demographic variables relate to health status across the population.

**RESULTS**

**Sample Description**

The participants of this study were drawn from the "2002 Taiwan National Health Promotion Knowledge, Attitude,



and Behaviour Survey" database compiled by the Health Promotion Administration, Ministry of Health and Welfare. A total of 26,755 valid responses were analysed to ensure reliability and representativeness, using frequency distributions and percentages to describe respondent characteristics. Table 5 below explains in detail. Gender: The sample consisted of 13,706 males (51.2%) and 13,049 females (48.8%), resulting in a nearly balanced gender distribution (Table 4-1-1).

Educational Level: Respondents varied in educational attainment. The majority had completed at least senior high school (30.5%), while 22.6% had completed college or university, and 2.2% held graduate degrees. A smaller proportion were illiterate (8.0%) or had incomplete or non-formal education (Table 4-1-2).

Age: The sample covered all age groups, with the largest proportions in the 25 years and below (20.1%) and 36–45 years (20.0%) categories. Respondents aged 76 and above represented the smallest group at 5.1%

| Variable           | Category                                                | Frequency (n) | Percentage (%) | Cumulative Percentage (%) |
|--------------------|---------------------------------------------------------|---------------|----------------|---------------------------|
| <b>Gender</b>      | Male                                                    | 13,706        | 51.2           | 51.2                      |
|                    | Female                                                  | 13,049        | 48.8           | 100                       |
| <b>Education</b>   | Illiterate                                              | 2,129         | 8              | 8                         |
|                    | Elementary School (Completed/Not Completed)             | 5,448         | 20.2           | 28.2                      |
|                    | Junior High School (Completed/Not Completed)            | 3,967         | 14.8           | 43                        |
|                    | Senior High School (Completed/Not Completed)            | 8,170         | 30.5           | 73.5                      |
|                    | College/University (Completed/Not Completed)            | 6,069         | 22.6           | 96.1                      |
|                    | Graduate School                                         | 576           | 2.2            | 98.3                      |
|                    | Literate without Formal Education                       | 335           | 1.3            | 99.6                      |
|                    | Open University (Not Completed)                         | 32            | 0.1            | 99.7                      |
|                    | Open Junior College / Technical Program (Not Completed) | 20            | 0.1            | 99.8                      |
|                    | Other / Unknown                                         | 9             | 0              | 100                       |
| <b>Age (Years)</b> | 25 and below                                            | 5,390         | 20.1           | 20.1                      |
|                    | 26–35                                                   | 5,073         | 19.1           | 39.2                      |
|                    | 36–45                                                   | 5,347         | 20             | 59.2                      |
|                    | 46–55                                                   | 4,158         | 15.5           | 74.7                      |
|                    | 56–65                                                   | 2,798         | 10.5           | 85.2                      |
|                    | 66–75                                                   | 2,616         | 9.8            | 95                        |
|                    | 76 and above                                            | 1,373         | 5.1            | 100                       |

**Table 5: Demographic Characteristics of Survey Respondents**

### Exercise Habits and Daily Sitting Time

#### Exercise Participation

Based on the processed data, as shown in Table 6 (Exercise Participation Analysis), among the 26,755 valid respondents,

| Exercise Status           | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|---------------------------|---------------|----------------|----------------------|---------------------------|
| <b>Exercise regularly</b> | 14,915        | 55.7           | 55.7                 | 55.7                      |
| <b>No exercise</b>        | 11,828        | 44.2           | 44.2                 | 100                       |
| <b>Missing</b>            | 12            | 0              | 0                    | 100                       |
| <b>Total</b>              | 26,755        | 100            | —                    | —                         |

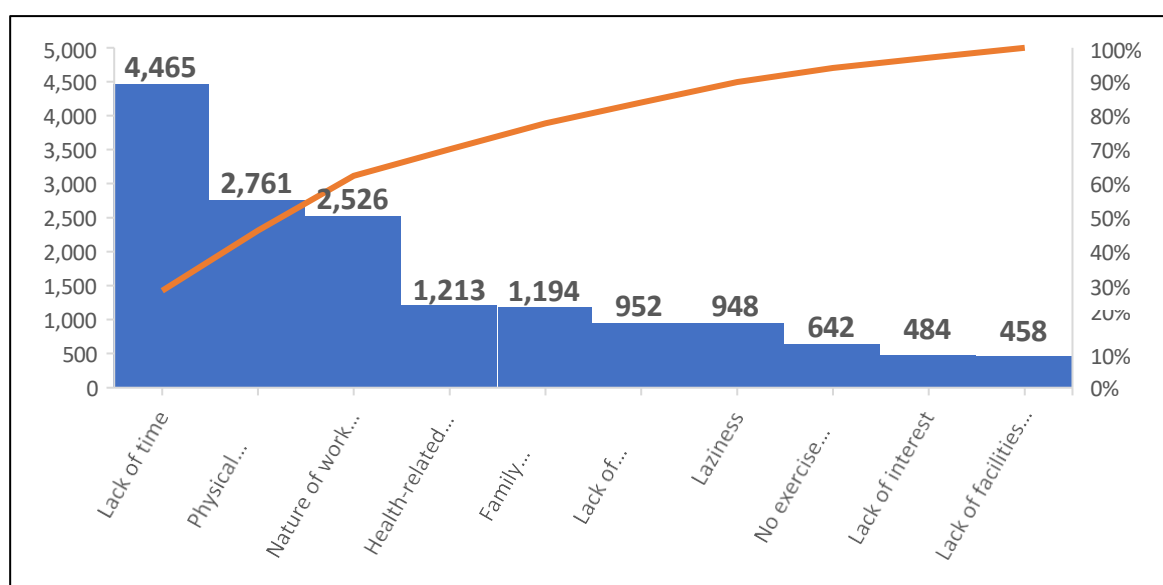
**Table 6 Exercise Participation Analysis**

#### Reasons for Not Exercising

As shown in Table 7 (Reasons for Not Exercising), the most common reason cited was a lack of time (38.3%), followed by physical exhaustion (23.7%) and considering work itself as physical activity (21.7%).

| Reason for Not Exercising         | Frequency (n) | Percentage (%) |
|-----------------------------------|---------------|----------------|
| Lack of time                      | 4,465         | 38.3           |
| Physical exhaustion               | 2,761         | 23.7           |
| Nature of work is itself exercise | 2,526         | 21.7           |
| Health-related reasons            | 1,213         | 10.4           |
| Family responsibilities           | 1,194         | 10.2           |
| Lack of encouragement             | 952           | 8.2            |
| Laziness                          | 948           | 8.1            |
| No exercise partner               | 642           | 5.5            |
| Lack of interest                  | 484           | 4.1            |
| Lack of facilities or space       | 458           | 3.9            |

**Table 7 Reasons for Not Exercising**



**Exercise Frequency**

As shown in Table 8 (Exercise Frequency Analysis), among the 26,755 valid respondents, 1.5% exercised less than once per week, 15.2% exercised once or twice per week, 11.3% exercised three to four times per week, 6.9% exercised five to six times per week, and 15.1% exercised seven times or more per week.

| Exercise Frequency (per week) | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-------------------------------|---------------|----------------|----------------------|---------------------------|
| Less than once                | 388           | 1.5            | 1.5                  | 1.5                       |
| 1–2 times                     | 4,079         | 15.2           | 15.2                 | 16.7                      |
| 3–4 times                     | 3,026         | 11.3           | 11.3                 | 28                        |
| 5–6 times                     | 1,839         | 6.9            | 6.9                  | 34.9                      |
| 7 times or more               | 4,039         | 15.1           | 15.1                 | 50                        |
| Irregular                     | 1,441         | 5.4            | 5.4                  | 55.4                      |
| Not applicable                | 11,828        | 44.2           | 44.2                 | 99.6                      |
| Missing values                | 115           | 0.4            | 0.4                  | 100                       |
| <b>Total</b>                  | <b>26,755</b> | <b>100</b>     | <b>100</b>           | <b>—</b>                  |

**Table 8 Exercise Frequency Analysis**

**Exercise Duration per Session**

As presented in Table 9 (Exercise Duration per Session), 11.1% of respondents exercised for less than 30 minutes per session, while 44.0% exercised for more than 30 minutes.

| Exercise Duration per Session | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-------------------------------|---------------|----------------|----------------------|---------------------------|
| Less than 30 minutes          | 2,971         | 11.1           | 11.1                 | 11.1                      |
| 30 minutes or more            | 23,784        | 44.0           | 44.0                 | 55.1                      |
| Irregular                     | 1,441         | 5.4            | 5.4                  | 60.5                      |
| Not applicable                | 11,828        | 44.2           | 44.2                 | 100                       |
| Missing values                | 115           | 0.4            | 0.4                  | 100                       |

|                                      |        |      |      |      |
|--------------------------------------|--------|------|------|------|
| <b>Within 15 minutes (inclusive)</b> | 1,641  | 2.4  | 2.4  | 6.1  |
| <b>16–29 minutes</b>                 | 1,320  | 4.9  | 4.9  | 11.1 |
| <b>30 minutes or more</b>            | 11,790 | 44   | 44   | 55.1 |
| <b>Not applicable</b>                | 11,828 | 44.2 | 44.2 | 99.3 |
| <b>Don't know</b>                    | 79     | 0.3  | 0.3  | 99.6 |
| <b>Missing / Unclear</b>             | 97     | 0.4  | 0.4  | 100  |
| <b>Total</b>                         | 26,755 | 100  | 100  | —    |

**Table 9 Exercise Duration per Session**

**Level of Perspiration During Exercise**

Based on Table 10 (Level of Perspiration During Exercise), 8.8% reported not sweating during exercise, 31.3% reported sweating mildly, and 15.5% reported heavy perspiration during workouts.

| Level of Perspiration       | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-----------------------------|---------------|----------------|----------------------|---------------------------|
| <b>No perspiration</b>      | 2,364         | 8.8            | 8.8                  | 8.8                       |
| <b>Mild perspiration</b>    | 8,363         | 31.3           | 31.3                 | 40.1                      |
| <b>Heavy perspiration</b>   | 4,160         | 15.5           | 15.5                 | 55.6                      |
| <b>Not applicable</b>       | 11,828        | 44.2           | 44.2                 | 99.9                      |
| <b>Missing / Not filled</b> | 40            | 0.1            | 0.1                  | 100                       |
| <b>Total</b>                | 26,755        | 100            | 100                  | —                         |

**Table 10: Level of Perspiration During Exercise**

**Breathing Intensity During Exercise**

Based on the processed data, as shown in Table 11(Breathing Intensity During Exercise), among the 26,755 valid samples, 25.7 % of respondents reported that they did *not* experience shortness of breath during exercise, 13.3 % experienced *slightly faster breathing*, 15.4 % felt *somewhat breathless*, and 1.1 % experienced *severe shortness of breath* where breathing became difficult.

| Breathing Intensity During Exercise | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-------------------------------------|---------------|----------------|----------------------|---------------------------|
| <b>No shortness of breath</b>       | 6,883         | 25.7           | 25.7                 | 25.7                      |
| <b>Slightly faster breathing</b>    | 3,570         | 13.3           | 13.3                 | 39.1                      |
| <b>Somewhat breathless</b>          | 4,122         | 15.4           | 15.4                 | 54.5                      |
| <b>Severe shortness of breath</b>   | 282           | 1.1            | 1.1                  | 55.5                      |
| <b>Not applicable</b>               | 11,828        | 44.2           | 44.2                 | 99.7                      |
| <b>Unknown / Not filled</b>         | 70            | 0.3            | 0.3                  | 100                       |
| <b>Total</b>                        | 26,755        | 100            | 100                  | —                         |

**Table 11 Breathing Intensity During Exercise**

**Reclassification of Exercise Variables**

To better assess overall physical activity levels, the variables exercise frequency, exercise duration, sweating level, and breathing intensity were recoded as shown in Table 12 (Recoding Scheme).

| Exercise Frequency | Recoded Value | Exercise Duration | Recoded Value | Sweating Level | Recoded Value | Breathing Intensity | Recoded Value |
|--------------------|---------------|-------------------|---------------|----------------|---------------|---------------------|---------------|
| 8                  | 0             |                   |               |                |               |                     |               |
| 1                  | 0.25          | 1                 | 0             | 1              | 0             | 1                   | 0             |
| 2                  | 0.5           | 2                 | 0.5           | 2              | 1             | 2                   | 0.5           |
| 3                  | 1             | 3                 | 1             | 3              | 1.5           | 3                   | 1             |
| 4                  | 1.5           | 888               | 0             | 8              | 0             | 4                   | 1.5           |
| 5                  | 2             |                   |               |                |               | 8                   | 0             |
| 6                  | 0.25          |                   |               |                |               |                     |               |
| 9                  | Missing       |                   |               | 9              | Missing       | 9                   | Missing       |

**Table 12: Recoding Scheme**

This recoding allowed for standardised comparisons among participants by converting categorical exercise responses into quantitative indices. The aggregated results were later used to classify participants' overall physical activity patterns for statistical analysis.

**Classification of Exercise Behavior**

According to the Sports Administration, Ministry of Education, regular exercisers are defined as individuals who



exercise at least three times per week for 30 minutes or more, reaching a heart rate of 130 bpm, or who sweat and feel short of breath (for those aged 60+, sweating alone suffices). Based on frequency, duration, sweating, and breathing intensity, respondents' exercise patterns were categorised into five groups:

**a) Regular Exercise:** meeting all three criteria, **b) Occasional Exercise:** meeting two criteria **c) Low-Intensity Exercise:** meeting one criterion, **d) Very Little Exercise:** meeting none of the criteria, **e) No Exercise:** no physical activity

After recoding, total scores were classified as: 0 = no exercise; 0.25–1.5 = very little; 1.75–2.75 = low-intensity; 3–3.75 = occasional; 4–6 = regular exercise.

After statistical recoding, as shown in Table 13, exercise scores were classified as follows:

| Exercise Type | No Exercise | Very Little Exercise | Low-Intensity Exercise | Occasional Exercise | Regular Exercise |
|---------------|-------------|----------------------|------------------------|---------------------|------------------|
| Score Range   | 0           | 0.25 – 1.5           | 1.75 – 2.75            | 3 – 3.75            | 4 – 6            |
| Frequency (n) | 11,829      | 987                  | 3,085                  | 5,367               | 5,487            |

**Table 13 Classification of Exercise Behavior**

As shown in Table 13, among 26,755 respondents, 11,829 (44.2%) did not exercise, 987 (3.7%) engaged in very little exercise, 3,085 (11.5%) in low-intensity exercise, 5,367 (20.1%) in occasional exercise, and 5,487 (20.5%) in regular exercise. Overall, around 40% of respondents engaged in regular or occasional physical activity, while nearly half (44.2%) did not exercise at all.

| Exercise Group                | Score | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-------------------------------|-------|---------------|----------------|----------------------|---------------------------|
| <b>No Exercise</b>            | 0     | 11,829        | 44.2           | 44.2                 | 44.2                      |
| <b>Very Little Exercise</b>   | 0.25  | 63            | 0.2            | 0.2                  | 44.4                      |
|                               | 0.5   | 71            | 0.3            | 0.3                  | 44.7                      |
|                               | 0.75  | 64            | 0.2            | 0.2                  | 45                        |
|                               | 1     | 138           | 0.5            | 0.5                  | 45.5                      |
|                               | 1.25  | 229           | 0.9            | 0.9                  | 46.3                      |
|                               | 1.5   | 422           | 1.6            | 1.6                  | 47.9                      |
| <b>Low-Intensity Exercise</b> | 1.75  | 97            | 0.4            | 0.4                  | 48.3                      |
|                               | 2     | 714           | 2.7            | 2.7                  | 50.9                      |
|                               | 2.25  | 457           | 1.7            | 1.7                  | 52.6                      |
|                               | 2.5   | 1,453         | 5.4            | 5.4                  | 58.1                      |
|                               | 2.75  | 364           | 1.4            | 1.4                  | 59.4                      |
| <b>Occasional Exercise</b>    | 3     | 2,482         | 9.3            | 9.3                  | 68.7                      |
|                               | 3.25  | 328           | 1.2            | 1.2                  | 69.9                      |
|                               | 3.5   | 2,361         | 8.8            | 8.8                  | 78.8                      |
|                               | 3.75  | 196           | 0.7            | 0.7                  | 79.5                      |
| <b>Regular Exercise</b>       | 4     | 2,818         | 10.5           | 10.5                 | 90                        |
|                               | 4.25  | 31            | 0.1            | 0.1                  | 90.1                      |
|                               | 4.5   | 1,566         | 5.9            | 5.9                  | 96                        |
|                               | 5     | 738           | 2.8            | 2.8                  | 98.8                      |
|                               | 5.5   | 306           | 1.1            | 1.1                  | 99.9                      |
|                               | 6     | 28            | 0.1            | 0.1                  | 100                       |
| <b>Total</b>                  | —     | 26,755        | 100            | 100                  | —                         |

**Table 14 Exercise Behavior Analysis**

The classification results reflect a clear stratification of physical activity among Taiwanese adults. While nearly half reported *no engagement in exercise*, about one-fifth exercised regularly, demonstrating a growing awareness of health benefits associated with consistent physical activity.

**Exercise Status among Agricultural, Forestry, Fishery, and Animal Husbandry Workers**

According to the processed data presented in Table 14, the population engaged in agriculture, forestry, fishery, and animal husbandry showed a significantly higher proportion of individuals who do not exercise compared with other occupational groups.

| Group                                                        | No Exercise | Very Little Exercise | Low-Intensity Exercise | Occasional Exercise | Regular Exercise | Total |
|--------------------------------------------------------------|-------------|----------------------|------------------------|---------------------|------------------|-------|
| Agricultural / Forestry / Fishery / Animal Husbandry Workers | 623         | 23                   | 64                     | 78                  | 82               | 870   |

**Table 15 Exercise Status of Agricultural, Forestry, Fishery, and Animal Husbandry Workers**

These results indicate that manual laborers in physically demanding fields often do not engage in separate leisure-time exercise, likely because their occupations already involve substantial physical exertion.

**Exercise Habits and Daily Sitting Time**

**Definition Criteria**

To measure leisure-time exercise and sedentary behavior, this study used the following criteria:

**Regular Exercise:** Engages in  $\geq 3$  sessions per week, each lasting  $\geq 30$  minutes, with sweating and mild-to-moderate breathlessness. Respondents meeting three or more of these four conditions were classified as regular exercisers.  
**Sedentary Behavior:** Spends  $\geq 8$  hours per day sitting (excluding sleep), including activities such as work, study, reading, TV, computer use, gaming, or homework.

**Work Activity Intensity:** Reports that daily work is not physically demanding ("does not require much physical effort").

**Identification of Leisure-Time Regular Exercisers**

Based on the processed data (Tables 15 and 16), among respondents who reported sitting for eight or more hours per day, 1,539 individuals engaged in regular exercise. Of these, 952 participants also indicated that their work or daily activities were not physically demanding. Consequently, these 952 individuals met all three criteria and were classified as the Leisure-Time Regular Exercise Group in this study.

| Sitting Time           | No Exercise | Very Little Exercise | Low-Intensity Exercise | Occasional Exercise | Regular Exercise | Total  |
|------------------------|-------------|----------------------|------------------------|---------------------|------------------|--------|
| < 8 hours per day      | 8,768       | 713                  | 2,249                  | 3,738               | 3,892            | 19,385 |
| $\geq 8$ hours per day | 2,937       | 256                  | 815                    | 1,614               | 1,539            | 7,161  |
| <b>Total (valid)</b>   | 11,705      | 969                  | 3,064                  | 5,352               | 5,431            | 26,546 |
| <b>Missing Values</b>  | —           | —                    | —                      | —                   | —                | 209    |
| <b>Grand Total</b>     | —           | —                    | —                      | —                   | —                | 26,755 |

**Table 16 Cross-Tabulation of Regular Exercise and Daily Sitting Time**

| Work Effort Intensity         | Regular Exercisers ( $\geq 8$ Hours Sitting) |
|-------------------------------|----------------------------------------------|
| Very physically demanding     | 98                                           |
| Somewhat physically demanding | 489                                          |
| Not physically demanding      | 952                                          |
| <b>Total</b>                  | 1,539                                        |

**Table 16 Cross-Analysis of Regular Exercisers ( $\geq 8$  Hours Sitting per Day) and Work Effort**

As shown in Table 16, among the 1,539 respondents who engaged in regular exercise while spending eight hours or more sitting per day, 98 individuals (6.4%) reported their work as very physically demanding, 489 individuals (31.8%) reported it as somewhat physically demanding, and 952 individuals (61.9%) indicated that their work was not physically demanding. Thus, 952 respondents who worked in non-physical occupations, exercised regularly, and spent eight hours or more sitting daily were identified as the Leisure-Time Regular Exercise Group in this study. This classification suggests that individuals in sedentary occupations are more likely to engage in planned exercise to maintain their physical health.

**Operational Definition of Agricultural, Forestry, Fishery, and Hunting Labourers**

Based on the processed data, the operational definition of agricultural, forestry, fishery, and hunting laborers in this study was established according to the following criteria:

**Industry Classification:**

As shown in Table 17, a total of 1,356 respondents were engaged in agriculture, forestry, fishery, animal husbandry, or hunting, accounting for 5.1% of all valid samples.

**Sedentary Behavior:**

The item "On average, excluding sleep, how many hours per day do you spend sitting (with little movement) including working, studying, reading, watching TV, using the computer, browsing the internet, gaming, or doing homework?" was used to assess sedentary time.

Respondents who reported sitting four hours or less per day were considered *non-sedentary*. Among the

agricultural, forestry, fishery, and hunting group, 1,074 individuals met this criterion.

**Work Effort Intensity:**

Regarding the question "Is your daily activity or work physically demanding?", responses of "very physically demanding" and "somewhat physically demanding" were used to identify labour-intensive occupations.

| Occupation Category                                                           | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-------------------------------------------------------------------------------|---------------|----------------|----------------------|---------------------------|
| Agriculture, Forestry, Fishery, Animal Husbandry, and Hunting                 | 1,356         | 5.1            | 5.1                  | 5.1                       |
| Manufacturing, Mining, Construction, and Public Utilities                     | 3,968         | 14.8           | 14.8                 | 19.9                      |
| Commerce                                                                      | 3,083         | 11.5           | 11.5                 | 31.4                      |
| Transportation and Communications (Road, Railway, Postal, Telecommunications) | 367           | 1.4            | 1.4                  | 32.8                      |
| Personal Services                                                             | 2,872         | 10.7           | 10.7                 | 43.5                      |
| Government Services                                                           | 1,019         | 3.8            | 3.8                  | 47.3                      |
| Professional Services                                                         | 2,033         | 7.6            | 7.6                  | 54.9                      |
| Unemployed                                                                    | 1             | 0              | 0                    | 54.9                      |
| Others (Unspecified or Unclassifiable Data)                                   | 32            | 0.1            | 0.1                  | 55.1                      |
| Not Applicable                                                                | 12,014        | 44.9           | 44.9                 | 100                       |
| Forgot / Cannot Recall                                                        | 1             | 0              | 0                    | 100                       |
| Don't Know / Unclear                                                          | 1             | 0              | 0                    | 100                       |
| Missing / Unfilled                                                            | 8             | 0              | 0                    | 100                       |
| <b>Total</b>                                                                  | <b>26,755</b> | <b>100</b>     | <b>100</b>           |                           |

**Table 17 Occupational Analysis Table**

As shown in Table 17, among the total of 26,755 valid respondents, the largest occupational category was Not Applicable (44.9%), followed by Manufacturing, Mining, Construction, and Public Utilities (14.8%), and Commerce (11.5%). The Agriculture, Forestry, Fishery, Animal Husbandry, and Hunting sector accounted for 5.1% of the total, representing a smaller but distinct group of manual laborers characterised by physically demanding work.

This distribution indicates that while a significant portion of the sample consisted of non-working or non-classified individuals, a substantial share were employed in various labor-intensive and service-oriented occupations, forming the foundation for later comparisons in this study.

| Average Daily Sitting Hours (Excluding Sleep) | Agricultural, Forestry, Fishery, and Hunting Laborers (n) |
|-----------------------------------------------|-----------------------------------------------------------|
| 0                                             | 3                                                         |
| 1                                             | 162                                                       |
| 2                                             | 365                                                       |
| 3                                             | 349                                                       |
| 4                                             | 195                                                       |
| 5                                             | 111                                                       |

|              |       |
|--------------|-------|
| 6            | 64    |
| 7            | 15    |
| 8            | 38    |
| 9            | 3     |
| 10           | 19    |
| 11           | 1     |
| 12           | 11    |
| 13           | 3     |
| 14           | 3     |
| 15           | 2     |
| 16           | 3     |
| 17-21        | 0     |
| Missing Data | 9     |
| Total        | 1,356 |

**Table 18 Cross-Analysis of Daily Sitting Time and Agricultural, Forestry, Fishery, and Hunting Laborers**

As shown in Table 18, most respondents in the agriculture, forestry, fishery, and animal husbandry sectors reported low levels of sedentary behaviour. Specifically, 1,074 individuals indicated they sat for four hours or less per day, confirming that this occupational group typically maintains high levels of physical activity throughout the workday.

| Question: "Is your daily activity or work physically demanding?" | Non-Agricultural Occupations | Agricultural, Forestry, Fishery, and Hunting Laborers | Total         |
|------------------------------------------------------------------|------------------------------|-------------------------------------------------------|---------------|
| Very physically demanding                                        | 2,690                        | 352                                                   | 3,042         |
| Somewhat physically demanding                                    | 8,223                        | 518                                                   | 8,741         |
| Not physically demanding                                         | 14,742                       | 204                                                   | 14,946        |
| Unknown / Missing                                                | 26                           | 0                                                     | 26            |
| <b>Total</b>                                                     | <b>25,681</b>                | <b>1,074</b>                                          | <b>26,755</b> |

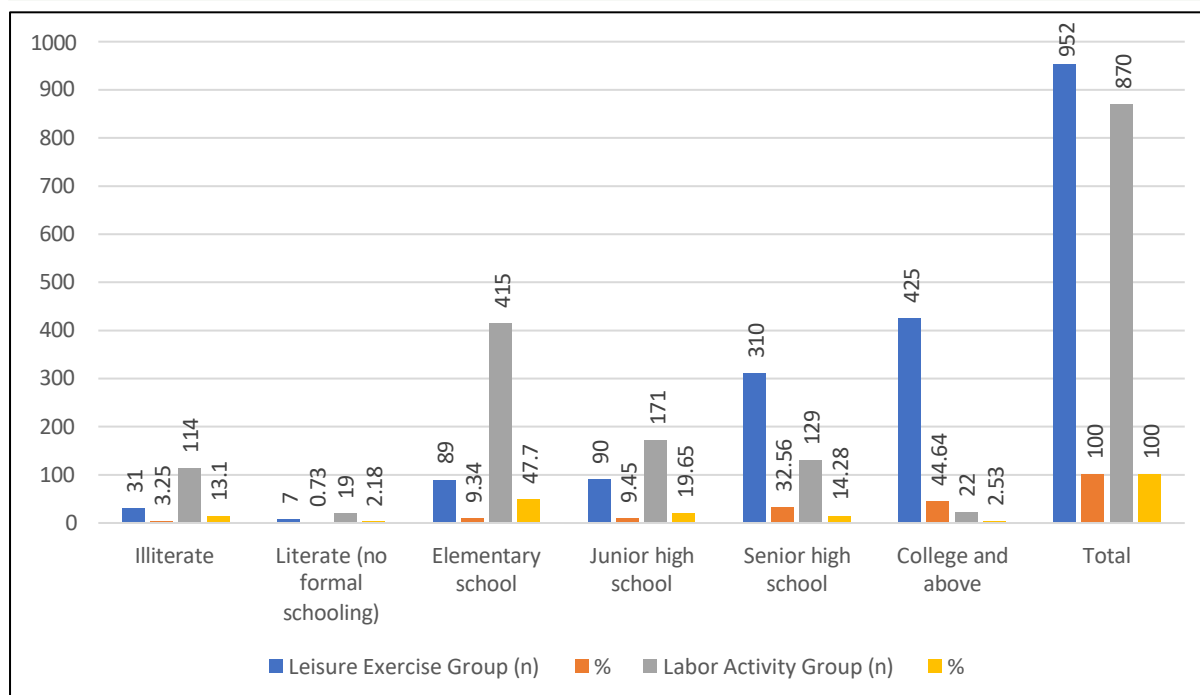
**Table 19 Cross-Analysis of Agricultural Laborers and Physical Workload**

Table 19 reveals that within the agricultural, forestry, fishery, and hunting group, 352 respondents (40.5%) considered their work very physically demanding, while 518 respondents (59.5%) reported it as somewhat physically demanding.

These results confirm that the majority of agricultural labourers engage in moderate to high-intensity physical labour, consistent with the operational definition employed in this study.

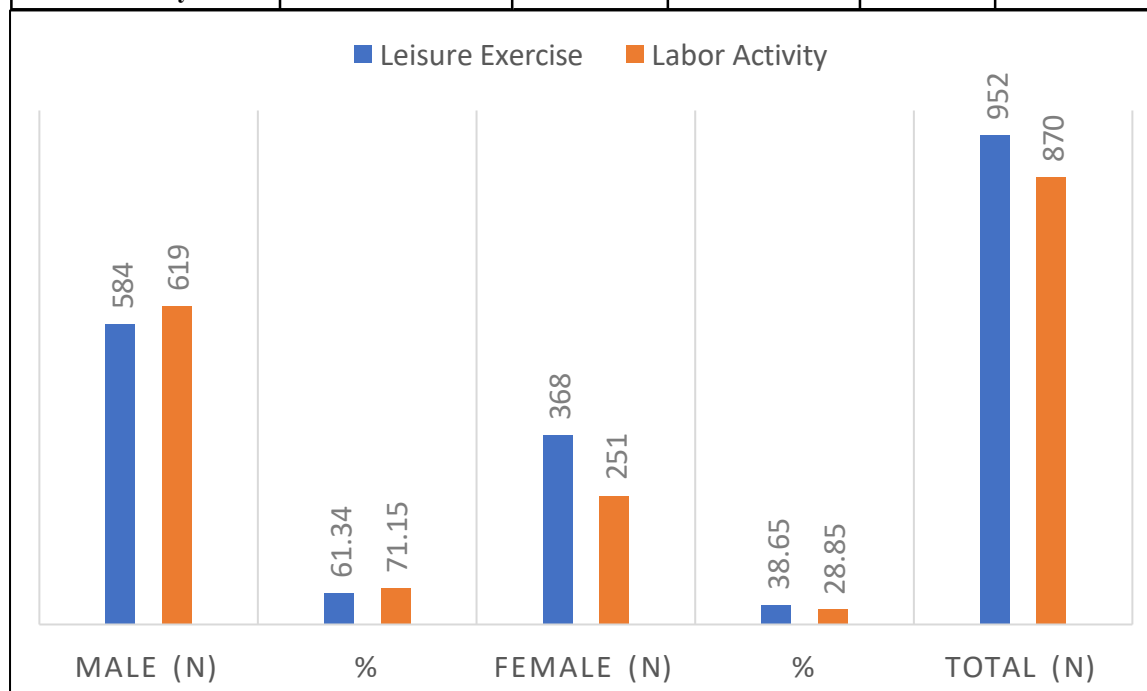
| Educational Level              | Leisure Exercise Group (n) | %          | Labor Activity Group (n) | %          |
|--------------------------------|----------------------------|------------|--------------------------|------------|
| Illiterate                     | 31                         | 3.25       | 114                      | 13.1       |
| Literate (no formal schooling) | 7                          | 0.73       | 19                       | 2.18       |
| Elementary school              | 89                         | 9.34       | 415                      | 47.7       |
| Junior high school             | 90                         | 9.45       | 171                      | 19.65      |
| Senior high school             | 310                        | 32.56      | 129                      | 14.28      |
| College and above              | 425                        | 44.64      | 22                       | 2.53       |
| <b>Total</b>                   | <b>952</b>                 | <b>100</b> | <b>870</b>               | <b>100</b> |

**Table 20: Educational Level Analysis of Leisure Exercise and Labor Activity Groups**



As illustrated in Table 20, the leisure exercise group had a notably higher educational level, with 44.64% holding a college degree or above. Conversely, the labor activity group primarily consisted of individuals with an elementary school education (47.7%). This suggests that higher educational attainment is positively associated with participation in leisure-time physical exercise, whereas manual labourers tend to have lower levels of formal education.

| Group            | Male (n) | %     | Female (n) | %     | Total (n) |
|------------------|----------|-------|------------|-------|-----------|
| Leisure Exercise | 584      | 61.34 | 368        | 38.65 | 952       |
| Labor Activity   | 619      | 71.15 | 251        | 28.85 | 870       |



**Table 21 Gender Distribution between Leisure Exercise and Labor Activity Groups**

As shown in Table 21, men accounted for a higher proportion in both groups, but particularly within the labour activity group (71.15%), compared to 61.34% in the leisure exercise group.

This finding suggests that men are more likely to engage in physically demanding occupations, whereas women are relatively more represented in leisure-based physical activity. It also reflects traditional gender divisions in labour, where manual or outdoor work remains predominantly male-dominated.

## Physical and Mental Health

### I. Physical Health

#### (1) Eight Major Diseases

According to the data analysis presented in Table 22, among the total 26,755 respondents, 17,820 individuals (66.6%) reported having no disease, 4,929 respondents (18.4%) reported hypertension, 2,326 (8.7%) had hyperlipidemia, 993 (3.7%) had heart disease, 477 (1.8%) had suffered from stroke, 151 (0.6%) were diagnosed with diabetes, 41 (0.2%) had asthma, 17 (0.1%) reported kidney disease, and only one respondent indicated having osteoporosis. This suggests that while chronic diseases such as hypertension and hyperlipidemia are relatively common, the overall prevalence of severe diseases remains low in the sample population.

| Disease Type    | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-----------------|---------------|----------------|----------------------|---------------------------|
| No disease      | 17,820        | 66.6           | 66.6                 | 66.6                      |
| Hypertension    | 4,929         | 18.4           | 18.4                 | 85                        |
| Hyperlipidaemia | 2,326         | 8.7            | 8.7                  | 93.7                      |
| Heart disease   | 993           | 3.7            | 3.7                  | 97.4                      |
| Stroke          | 477           | 1.8            | 1.8                  | 99.2                      |
| Diabetes        | 151           | 0.6            | 0.6                  | 99.8                      |
| Asthma          | 41            | 0.2            | 0.2                  | 99.9                      |
| Kidney disease  | 17            | 0.1            | 0.1                  | 100                       |
| Osteoporosis    | 1             | 0              | 0                    | 100                       |
| Total           | 26,755        | 100            | 100                  |                           |

**Table 22 Analysis of Eight Major Diseases (2) Seven Daily Living Activities**

As shown in Table 23, the analysis of daily living activities among 26,754 respondents indicated that:

- The mean score was 0.07 and the standard deviation was 0.404, Suggesting that most participants reported no difficulty performing basic household tasks (e.g., cooking, washing, cleaning).
- The range for each item was between 0 (no difficulty) and 3 (completely unable).

| Daily Living Task                                   | Sample (n) | Min | Max | Mean | SD    |
|-----------------------------------------------------|------------|-----|-----|------|-------|
| Doing household chores (cleaning, washing, cooking) | 26,754     | 0   | 3   | 0.07 | 0.404 |
| Bathing independently                               | 1,000      | 0   | 3   | 1.27 | 1.27  |
| Dressing/undressing                                 | 999        | 0   | 3   | 1.08 | 1.245 |
| Eating independently                                | 1,001      | 0   | 3   | 0.64 | 1.093 |
| Getting in and out of bed                           | 1,001      | 0   | 3   | 0.88 | 1.148 |
| Moving indoors                                      | 1,000      | 0   | 3   | 1.02 | 1.18  |
| Using the toilet                                    | 1,000      | 0   | 3   | 0.93 | 1.193 |
| Valid N (complete cases)                            | 998        |     |     |      |       |
| Daily Living Task                                   | Sample (n) | Min | Max | Mean | SD    |
| Doing household chores (cleaning, washing, cooking) | 26,754     | 0   | 3   | 0.07 | 0.404 |
| Bathing independently                               | 1,000      | 0   | 3   | 1.27 | 1.27  |
| Dressing/undressing                                 | 999        | 0   | 3   | 1.08 | 1.245 |
| Eating independently                                | 1,001      | 0   | 3   | 0.64 | 1.093 |
| Getting in and out of bed                           | 1,001      | 0   | 3   | 0.88 | 1.148 |
| Moving indoors                                      | 1,000      | 0   | 3   | 1.02 | 1.18  |
| Using the toilet                                    | 1,000      | 0   | 3   | 0.93 | 1.193 |
| Valid N (complete cases)                            | 998        |     |     |      |       |

**Table 23 Analysis of Seven Daily Living Activities**



The results reveal that most respondents had strong daily functioning abilities, with only a small proportion indicating difficulty in physical activities such as mobility or self-care.

| Variable                   | Sample (n) | Min | Max | Mean   | SD     |
|----------------------------|------------|-----|-----|--------|--------|
| Six Daily Living Abilities | 998        | 0   | 3   | 0.9694 | 1.0624 |
| Valid N (complete cases)   | 998        |     |     |        |        |

**Table 24 Analysis of Six Daily Activity Abilities**

In Table 24, among 998 valid respondents, the mean score of 0.97 (SD = 1.06) indicates that the majority were capable of performing daily activities independently, with only mild limitations reported in a small subset of participants.

**(3) Self-Perceived Current Health Status and Comparison with the Previous Year**

| Self-Perceived Health Status | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|------------------------------|---------------|----------------|----------------------|---------------------------|
| Excellent                    | 5,057         | 18.9           | 18.9                 | 18.9                      |
| Good                         | 8,951         | 33.5           | 33.5                 | 52.4                      |
| Fair                         | 9,234         | 34.5           | 34.5                 | 86.9                      |
| Poor                         | 2,973         | 11.1           | 11.1                 | 98                        |
| Very poor                    | 534           | 2              | 2                    | 100                       |
| Total                        | 26,749        | 100            | 100                  |                           |
| Missing / Unfilled           | 6             | 0              |                      |                           |
| Grand Total                  | 26,755        | 100            |                      |                           |

**Table 25 Current Health Status**

The majority of respondents rated their current health as "good" (33.5%) or "fair" (34.5%), indicating that over two-thirds perceived themselves in average to above-average health. Only 2.0% considered their health as "very poor."

| Compared with One Year Ago | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|----------------------------|---------------|----------------|----------------------|---------------------------|
| Much better                | 416           | 1.6            | 1.6                  | 1.6                       |
| Slightly better            | 2,190         | 8.2            | 8.2                  | 9.7                       |
| About the same             | 17,012        | 63.6           | 63.6                 | 73.4                      |
| Slightly worse             | 5,998         | 22.4           | 22.4                 | 95.8                      |
| Much worse                 | 1,123         | 4.2            | 4.2                  | 100                       |
| Total                      | 26,739        | 99.9           | 100                  |                           |
| Missing / Unfilled         | 16            | 0.1            |                      |                           |
| Grand Total                | 26,755        | 100            |                      |                           |

**Table 26 Comparison of Current Health with One Year Ago**

Most respondents (63.6%) reported that their health remained unchanged compared to the previous year, while 23.9% perceived some degree of decline. Only 9.8% felt their health had improved, suggesting an overall stable health trend among the majority of the sample.

**II. Mental Health (Depression)**

According to data analysis in Tables 27 and 28, 1,295 respondents (4.8%) exhibited depressive tendencies, while 25,287 respondents (94.5%) reported no signs of depression.

| Depression Level (TDQ Scale) | Frequency (n) | Percentage (%) |
|------------------------------|---------------|----------------|
| 0 (No depressive symptoms)   | 6,837         | 25.6           |
| 1–8 (Emotionally stable)     | 14,415        | 53.9           |

|                                          |        |      |
|------------------------------------------|--------|------|
| <b>9–14 (Mild emotional fluctuation)</b> | 3,120  | 11.7 |
| <b>15–18 (Depression threshold)</b>      | 915    | 3.4  |
| <b>≥19 (Severe depressive mood)</b>      | 1,295  | 4.8  |
| <b>Missing data</b>                      | 173    | 0.6  |
| <b>Total</b>                             | 26,755 | 100  |

**Table 27 Depression Symptom Analysis**

| Group                              | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|------------------------------------|---------------|----------------|----------------------|---------------------------|
| <b>With depressive tendency</b>    | 1,295         | 4.8            | 4.8                  | 4.8                       |
| <b>Without depressive tendency</b> | 25,287        | 94.5           | 94.5                 | 100                       |
| <b>Valid total</b>                 | 26,582        | 96.3           | 100                  |                           |
| <b>Missing (system-defined)</b>    | 173           | 0.6            |                      |                           |
| <b>Grand Total</b>                 | 26,755        | 100            |                      |                           |

**Table 28 Analysis of Depressive and Non-Depressive Groups**

The results indicate that emotional stability was prevalent among the majority of respondents, with nearly 80% falling within the "no symptoms" or "emotionally stable" range. Only 4.8% met the criteria for potential depressive symptoms (TDQ ≥ 19), aligning with global averages for mild depressive tendencies in community populations.

**Factors Influencing Physical Health**

**1. Smoking**

According to Table 4-5-1, among 26,755 valid respondents, 9,782 individuals (36.6%) reported that they had smoked at some point in their life, while 16,971 individuals (63.4%) had never smoked. This suggests that more than one-third of the surveyed population had experienced smoking behavior at least once.

| Category                       | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|--------------------------------|---------------|----------------|----------------------|---------------------------|
| <b>Ever smoked</b>             | 9,782         | 36.6           | 36.6                 | 36.6                      |
| <b>Never smoked</b>            | 16,971        | 63.4           | 63.4                 | 100                       |
| <b>Total (valid)</b>           | 26,753        | 100            | 100                  |                           |
| <b>Proxy unknown / missing</b> | 2             | 0              |                      |                           |
| <b>Grand Total</b>             | 26,755        | 100            |                      |                           |

**Table 29 Smoking Behavior Analysis**

**2. Betel-Nut Chewing**

As shown in Table 30, 20,902 respondents (78.1%) had never chewed betel nut, 2,108 (7.9%) had chewed only 1–2 times, 2,738 (10.2%) were current chewers, and 1,000 (3.7%) were former chewers who had quit for more than six months. This indicates that while the majority of Taiwanese adults do not chew betel nut, approximately one-tenth remain active users, which aligns with public-health data on habitual consumption in blue-collar groups.

| Response                                           | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|----------------------------------------------------|---------------|----------------|----------------------|---------------------------|
| <b>Never chewed</b>                                | 20,902        | 78.1           | 78.1                 | 78.1                      |
| <b>Chewed 1–2 times only</b>                       | 2,108         | 7.9            | 7.9                  | 86                        |
| <b>Currently chewing (including past 6 months)</b> | 2,738         | 10.2           | 10.2                 | 96.2                      |
| <b>Former chewer (no chewing in past 6 months)</b> | 1,000         | 3.7            | 3.7                  | 100                       |
| <b>Missing / Unfilled</b>                          | 7             | 0              | 0                    | 100                       |
| <b>Total</b>                                       | 26,755        | 100            | 100                  |                           |

**Table 30 Betel-Nut Chewing Analysis**

**3. Alcohol Consumption**

From Table 31, 9,961 respondents (37.2%) reported drinking alcohol (including occasional or social drinking), whereas 16,786 (62.7%) stated that they do not drink at all. This demonstrates a moderate level of alcohol use among adults, with abstinence more prevalent among older or health-conscious groups.

| Response                            | Frequency (n) | Percentage (%) | Valid Percentage (%) | Cumulative Percentage (%) |
|-------------------------------------|---------------|----------------|----------------------|---------------------------|
| Yes (including occasional drinking) | 9,961         | 37.2           | 37.2                 | 37.2                      |
| No (total abstinence)               | 16,786        | 62.7           | 62.7                 | 100                       |
| Missing / Unfilled                  | 8             | 0              | 0                    | 100                       |
| Total                               | 26,755        | 100            | 100                  |                           |

**Table 31 Alcohol Consumption Analysis**

**Interference of Age**

| Source                                          | Type III Sum of Squares | df    | Mean Square | F        | Sig. (p) |
|-------------------------------------------------|-------------------------|-------|-------------|----------|----------|
| Corrected Model                                 | 349.994                 | 141   | 2.482       | 3.226    | 0        |
| Intercept                                       | 4,597.54                | 1     | 4,597.54    | 5,975.02 | 0        |
| Leisure vs. Labor Activity (Physical Intensity) | 0.318                   | 1     | 0.318       | 0.414    | 0.52     |
| Age                                             | 242.419                 | 75    | 3.232       | 4.201    | 0        |
| Interaction (Physical Intensity × Age)          | 55.65                   | 65    | 0.856       | 1.113    | 0.252    |
| Error                                           | 1,919.81                | 2,495 | 0.769       |          |          |
| Total                                           | 17,102.00               | 2,637 |             |          |          |

**Table 32: Analysis of Current Health Status**

Age demonstrated a significant effect on current health status ( $p < 0.05$ ), whereas the type of physical activity (leisure vs. labour) did not reach statistical significance ( $p = 0.520$ ). The interaction between activity type and age was also nonsignificant ( $p = 0.252$ ), indicating that age has a stronger influence on perceived health than occupational or recreational physical workload.

| Variable             | Group (n)              | Mean Age | Mean Score | F     | p     |
|----------------------|------------------------|----------|------------|-------|-------|
| Eight Diseases       | Leisure Exercise (952) | 36.15    | 0.4926     | 8.076 | 0.005 |
|                      | Labor Activity (870)   | 52.58    | 0.6011     |       |       |
| Six Daily Activities | Leisure Exercise       | 36.15    | 0.7        | 2.11  | 0.154 |
|                      | Labor Activity         | 52.58    | 0.2        |       |       |
| Depression           | Leisure Exercise       | 36.15    | 0.2655     | 1.46  | 0.227 |
|                      | Labor Activity         | 52.58    | 0.2494     |       |       |

**Table 33: Disease, Activity, and Depression by Group**

Age significantly affected the incidence of diseases ( $p < 0.05$ ). Respondents in the labor-activity group were older on average (52.6 years) and exhibited higher cumulative disease scores than those in the leisure-exercise group (36.1 years). However, daily activity ability and depression did not differ significantly by group.

| Age Group (Years) | Leisure Exercise Mean | Labor Activity Mean | F      | p     |
|-------------------|-----------------------|---------------------|--------|-------|
| ≤ 25              | 0.716                 | 0.283               | 0.137  | 0.711 |
| 26 – 35           | 0.164                 | 0.081               | 3.173  | 0.076 |
| 36 – 45           | 0.358                 | 0.309               | 0.452  | 0.502 |
| 46 – 55           | 1.066                 | 0.891               | 9.336  | 0.002 |
| 56 – 65           | 1.37                  | 0.848               | 16.75  | 0     |
| ≥ 66              | 1.697                 | 0.91                | 45.562 | 0     |

**Table 34: Age Group and Disease Comparison**

For participants aged 46 and above, the results were statistically significant ( $p < 0.05$ ). The leisure-exercise group exhibited a higher mean disease score than the labour group, suggesting that despite healthier lifestyles, older leisure exercisers may already experience chronic conditions, whereas younger labourers remain relatively healthy due to their occupational activity.

**Interference of Smoking**

| Health Variable       | Leisure Mean (952) | Exercise | Labor Mean (870) | Activity | F     | p     |
|-----------------------|--------------------|----------|------------------|----------|-------|-------|
| Current Health Status | 2.31               |          | 2.43             |          | 2.264 | 0.133 |
| Eight Diseases Total  | 0.5297             |          | 0.4842           |          | 0.371 | 0.543 |
| Six Daily Activities  | 0.2222             |          | 0.3333           |          | 0.25  | 0.667 |
| Depression Index      | 0.2903             |          | 0.2171           |          | 6.92  | 0.012 |

**Table 35: Smoking and Health Indicators**

Smoking showed a significant effect on depression ( $p < 0.05$ ), with the leisure-exercise group displaying a higher depression mean than the labour-activity group. However, no significant differences were observed for current health or physical functioning, suggesting that smoking may primarily affect mental health rather than immediate physical indicators.

| Health Variable       | Leisure Mean | Exercise | Labour Mean | Activity | F      | p     |
|-----------------------|--------------|----------|-------------|----------|--------|-------|
| Current Health Status | 2.25         |          | 2.6         |          | 50.705 | 0     |
| Eight Diseases Total  | 0.4177       |          | 0.652       |          | 21.961 | 0     |
| Six Daily Activities  | 0.675        |          | 0.2222      |          | 0.954  | 0.34  |
| Depression            | 0.2567       |          | 0.2779      |          | 1.438  | 0.231 |

**Table 36: Non-Smoking and Health Indicators**

Among non-smokers, both health status and disease incidence differed significantly between groups ( $p < 0.05$ ). The labour-activity group reported poorer health and higher disease totals, suggesting occupational stress and exposure may offset the benefits of non-smoking.

**Interference of Alcohol Consumption**

| Health Variable       | Leisure Mean | Exercise | Labour Mean | Activity | F     | p     |
|-----------------------|--------------|----------|-------------|----------|-------|-------|
| Current Health Status | 2.17         |          | 2.38        |          | 0.584 | 0.451 |
| Eight Diseases Total  | 0.5833       |          | 0.3333      |          | 0.627 | 0.434 |
| Depression            | 0.2454       |          | 0.254       |          | 0.006 | 0.936 |

**Table 37: Drinking and Health Indicators**

No statistically significant differences were found ( $p > 0.05$ ), indicating that moderate drinking did not have a noticeable effect on physical or mental health between the two activity groups.

| Health Variable       | Leisure Mean | Exercise | Labor Mean | Activity | F      | p    |
|-----------------------|--------------|----------|------------|----------|--------|------|
| Current Health Status | 2.26         |          | 2.68       |          | 51.559 | 0    |
| Eight Diseases Total  | 0.4511       |          | 0.6946     |          | 16.309 | 0    |
| Depression            | 0.675        |          | 0.1667     |          | 2.804  | 0.09 |

**Table 38: Non-Drinking and Health Indicators**

Among non-drinkers, the labour-activity group exhibited significantly poorer health and higher disease prevalence ( $p < 0.05$ ). This pattern mirrors that of non-smokers, indicating that occupational factors rather than substance use are key determinants of physical health in this population.

**Interference of Betel-Nut Chewing**

| Chewing Frequency (in past 6 months) | Leisure (n) | Exercise (n) | Labour Activity (n) | Total (n)    |
|--------------------------------------|-------------|--------------|---------------------|--------------|
| Daily (6–7 days/week)                | 1           |              | 125                 | 126          |
| 3–5 days/week                        | 1           |              | 19                  | 20           |
| 1–2 days/week                        | 1           |              | 38                  | 39           |
| Several times per month              | 1           |              | 21                  | 22           |
| Occasional / Irregular               | 0           |              | 2                   | 2            |
| Not Applicable (Non-chewers)         | 948         |              | 664                 | 1,612        |
| Missing                              | 0           |              | 1                   | 1            |
| <b>Total</b>                         | <b>952</b>  |              | <b>870</b>          | <b>1,822</b> |

**Table 39: Leisure Exercise and Labour Activity × Betel-Nut Chewing**

Within the leisure-exercise group, only 4 participants reported chewing betel nut, compared with 203 in the labor group, indicating that chewing behavior is strongly associated with manual labour occupations.

| Health Variable       | Leisure Exercise Mean | Labour Activity Mean | F      | p     |
|-----------------------|-----------------------|----------------------|--------|-------|
| Current Health Status | 2.25                  | 2.62                 | 51.608 | 0     |
| Eight Diseases Total  | 0.4189                | 0.643                | 19.218 | 0     |
| Six Daily Activities  | 0.657                 | 0.3333               | 0.363  | 0.554 |
| Depression            | 0.257                 | 0.2714               | 0.634  | 0.426 |

**Table 40: Non-Chewing and Health Indicators**

Among non-chewers, significant differences were observed in both health status and disease prevalence ( $p < 0.05$ ). The labour-activity group demonstrated worse health and more diseases than the leisure-exercise group, suggesting that occupational workload, rather than betel-nut abstinence, remains the dominant health factor.

**DISCUSSION**

The primary objective of this study was to investigate the differences in physiological and psychological health benefits between leisure-time exercise and occupational physical labour, while controlling for the potential confounding effects of smoking, alcohol consumption, and betel-nut chewing. The following discussion is organised according to the controlled factors and corresponding analytical results.

**Influence of Age**

Based on the results, individuals engaged in labour-intensive activities exhibited a higher prevalence of the eight identified diseases compared to those in the leisure and exercise group.

However, age stratification revealed a nuanced pattern: Among participants younger than 45 years, there was no significant difference in disease occurrence between the two groups.

For participants aged 46 years and above, the leisure-exercise group showed a higher incidence of chronic diseases compared to the labour-activity group. This suggests that although leisure-time exercise is typically associated with better health outcomes, the accumulated age effect may outweigh the benefits of exercise among older adults. Older individuals who engage in leisure activities may already experience age-related physiological decline, which explains the higher disease prevalence observed in this group (Huffman & Szafron, 2017; Langhammer et al., 2018; Sisson et al., 2009).

**Influence of Smoking**

According to the results, within the population of daily smokers, the leisure-exercise group recorded higher depression scores than the labour-activity group. This could indicate that individuals who smoke yet engage in leisure exercise might experience psychological stress or role imbalance, affecting mental well-being. Conversely, among non-smokers, the leisure-exercise group exhibited better overall health and lower disease rates than the labour-activity group. This finding confirms that the absence of smoking magnifies the positive effects of leisure exercise on both physical and psychological health (Biswas et al., 2025; Su et al., 2025).

**Influence of Alcohol Consumption**

Comparisons between daily drinkers in both groups revealed no significant difference in physical or mental health. However, among non-drinkers, the leisure-exercise group again performed better in terms of health status and

disease incidence. This pattern reinforces that healthy lifestyle behaviours, such as abstaining from alcohol, interact with exercise to produce more favourable outcomes, whereas for habitual drinkers, the health impact of exercise may be partially neutralised (Rodrigues & Delerue-Matos, 2025; Shen & Zhou, 2024; Szeszák et al., 2025).

### **Influence of Betel-Nut Chewing**

The data presented in the results show that only 4 respondents in the leisure-exercise group reported chewing betel nut, compared with 203 respondents in the labour-activity group, confirming that the habit is predominantly associated with manual or blue-collar occupations.

As further demonstrates, among non-chewers, the leisure-exercise group showed significantly better health conditions and fewer diseases than the labour-activity group. Given the limited sample of betel-nut chewers in the exercise group, a statistical comparison was not feasible; however, the overall pattern again supports the association between labour intensity, habit prevalence, and weaker health outcomes (Iso-Ahola & Baumeister, 2023).

### **Comparative Interpretation of Lifestyle Factors**

When synthesising results across age, smoking, drinking, and betel-nut habits, several consistent patterns emerge: In terms of age, disease prevalence was higher in the labour-activity group overall. Among participants under 45, no difference was observed, but among those aged 46 and above, leisure exercisers exhibited more age-related chronic illnesses, suggesting age itself is a decisive factor. Regarding smoking, daily smokers in the leisure group had greater depressive tendencies, whereas non-smokers in the labour group experienced poorer physical health. For drinking, daily consumption showed no group differences, but among non-drinkers, the labour group's health and disease indicators were worse. As for betel-nut chewing, the sample size for leisure exercisers was too small to compare; however, among non-chewers, the labour group again had poorer health outcomes.

Overall, these results indicate that among participants who do not smoke, drink, or chew betel nut, the labour-activity group still exhibits poorer health, suggesting that occupational workload and age effects outweigh the influence of personal lifestyle habits (Su et al., 2024).

## **CONCLUSION**

In summary, age is the most dominant predictor of physical health outcomes, exerting a stronger influence than smoking, alcohol, or betel-nut consumption. When controlling for lifestyle behaviours, individuals of the same age group who do not have unhealthy habits exhibit similar health outcomes, regardless of whether they engage in leisure exercise or labour activity.

This indicates that, under comparable conditions, both leisure and occupational physical activities can contribute to maintaining equivalent levels of health and well-being.

The findings suggest that individuals in physically demanding occupations are less likely to engage in leisure-time exercise compared to those in less physically strenuous occupations. This suggests that fatigue resulting from heavy labour reduces motivation and available time for additional physical activity during leisure hours. The average age of participants in the leisure-exercise group was 32.94 years, while the labour-activity group averaged 54.67 years. It was evident that the labour group exhibited a higher prevalence of age-related chronic diseases, including hypertension, heart disease, diabetes, and osteoporosis. However, after controlling for age, the differences between the two groups became statistically insignificant, indicating that age is the primary determinant of health disparities rather than activity type alone.

Among individuals engaged in physically demanding work, those who do not smoke, drink alcohol, or chew betel nut are likely to experience similar health benefits to those who participate in regular leisure-time exercise. This suggests that maintaining a healthy lifestyle can help mitigate the physiological stress associated with labour-intensive occupations, resulting in comparable physical and mental health outcomes.

The results show that the physical and psychological health benefits between the agriculture, forestry, fishery, and animal husbandry (AFFH) population and the leisure-exercise group were not significantly different. However, since the AFFH group was older on average and exhibited slightly poorer disease conditions, it is recommended that public health authorities strengthen health education campaigns, provide regular consultation services, and organise early disease screening programs to promote preventive healthcare and early medical intervention for these populations.

Given that the health benefits of rural labour activities are comparable to those derived from leisure-time exercise, policymakers should reconsider large-scale investments in constructing exercise facilities in rural regions. Instead, resources could be more effectively directed toward creating health-friendly environments, promoting green exercise initiatives, and improving access to medical services. Such measures would align more closely with the actual lifestyle and environmental needs of rural and agricultural populations.

This study demonstrates that while leisure-time exercise contributes positively to health, occupational physical activity, when combined with healthy habits, can yield comparable benefits. Ultimately, age and lifestyle behaviours exert a more substantial influence on health outcomes than the type of physical activity itself, emphasising the importance of health education, preventive screening, and supportive environments for all working populations, particularly in rural and labour-intensive sectors.



## REFERENCE

1. Abdullah, Mathiyakom, W., Asai, T., Ali, I., Ullah, S., & Tantisuwat, A. (2025). Comparison of balance, functional capacity, and quality of life between older adults with lower and higher levels of physical activity. *BMC geriatrics*, 25(1), 786.
2. Anim, A. O., Lutterodt, H. E., Ofori, C. W., Boateng, I. O., Bonsu, J. A., Ankar-Brewoo, G. M., ... & Annan, R. A. (2025). The Impact of Agricultural practices on food composition—A systematic review. *Journal of Food Composition and Analysis*, 108388.
3. Arslan, T., Kara, B., & Arslan, S. (2018). Comparison of physical activity levels of elderly people living in rural and urban areas of Turkey. *Spor Hekimliği Dergisi*, 53(3), 101-108.
4. Autenrieth CS1, Baumert J, Baumeister SE, Fischer B, Peters A, Döring A, Thorand B (2011) . Association between domains of physical activity and all-cause, cardiovascular and cancer mortality. *European Journal of Epidemiology*, 26 (2) : 91-99
5. Besser, L. M., & Dannenberg, A. L. (2005). Walking to public transit: steps to help meet physical activity recommendations. *American journal of preventive medicine*, 29(4), 273-280.
6. Biswas, J., Hasan, M. N., Gazi, M. S. R., & Rahman, M. M. (2025). Enhancing mental well-being: An artificial intelligence model for predicting mental disorders. *Array*, 100417.
7. Borodulin, K., & Anderssen, S. (2023). Physical activity: associations with health and summary of guidelines. *Food & Nutrition Research*, 67, 10-29219.
8. Carek, P. J., Laibstain, S. E., & Carek, S. M. (2011). Exercise for the treatment of depression and anxiety. *The international journal of psychiatry in medicine*, 41(1), 15-28.
9. Caspersen, C. J., Powell, K. E., & Christenson, G. M. (1985). Physical activity, exercise, and physical fitness: definitions and distinctions for health-related research. *Public health reports*, 100(2), 126.
10. Chang, C. K., & Wu, C. L. (2023). Results from the Chinese Taipei (Taiwan) 2022 report card on physical activity for children and youth. *Journal of Exercise Science & Fitness*, 21(1), 6-13.
11. Chao, T. H., Lin, T. H., Cheng, C. I., Wu, Y. W., Ueng, K. C., Wu, Y. J., ... & Chen, W. J. (2024). 2024 guidelines of the Taiwan society of cardiology on the primary prevention of atherosclerotic cardiovascular disease---Part I. *Acta Cardiologica Sinica*, 40(5), 479.
12. Chen, M. Y. (2021). Misperception of cardiometabolic risks and health needs among agriculture and aquaculture workers in Taiwan. *European Journal of Cardiovascular Nursing*, 20(4), 383-388.
13. Childs, E., & De Wit, H. (2014). Regular exercise is associated with emotional resilience to acute stress in healthy adults. *Frontiers in physiology*, 5, 87290.
14. Cillekens, B., Huysmans, M. A., Holtermann, A., van Mechelen, W., Straker, L., Krause, N., ... & Coenen, P. (2022). Physical activity at work may not be health enhancing. A systematic review with meta-analysis on the association between occupational physical activity and cardiovascular disease mortality covering 23 studies with 655 892 participants. *Scandinavian journal of work, environment & health*, 48(2), 86.
15. Coenen, P., Huysmans, M. A., Holtermann, A., Troiano, R. P., Mork, P. J., Krokstad, S., ... & Van Der Beek, A. J. (2024). Associations of occupational and leisure-time physical activity with all-cause mortality: an individual participant data meta-analysis. *British Journal of Sports Medicine*, 58(24), 1527-1538.
16. Colberg, S. R., Sigal, R. J., Yardley, J. E., Riddell, M. C., Dunstan, D. W., Dempsey, P. C., ... & Tate, D. F. (2016). Physical activity/exercise and diabetes: a position statement of the American Diabetes Association. *Diabetes care*, 39(11), 2065.
17. Edward W. Gregg et al. (1998) , Physical activity reduces hip fracture risk in older women, *Women's Health Weekly*, 8/17-8/24, 14.
18. Fancourt, D., Aughterson, H., Finn, S., Walker, E., & Steptoe, A. (2021). How leisure activities affect health: a narrative review and multi-level theoretical framework of mechanisms of action. *The Lancet Psychiatry*, 8(4), 329-339.
19. Francis, K. (1996). Physical activity in the prevention of cardiovascular disease. *Physical Therapy*, 76, 456-468.
20. Greggi, C., Visconti, V. V., Albanese, M., Gasperini, B., Chiavoghilefu, A., Prezioso, C., ... & Tarantino, U. (2024). Work-related musculoskeletal disorders: a systematic review and meta-analysis. *Journal of Clinical Medicine*, 13(13), 3964.
21. Gudnadottir, U., Cadmus-Bertram, L., Spicer, A., Gorzelitz, J., & Malecki, K. (2019). The relationship between occupational physical activity and self-reported vs measured total physical activity. *Preventive medicine reports*, 15, 100908.
22. Haennel, R. G., & Lemire, F. (2002). Physical activity to prevent cardiovascular disease. How much is enough?. *Canadian Family Physician*, 48(1), 65-71.
23. Hanna, F., You, E., & El-Sherif, M. (2023). The impact of sedentary behavior and virtual lifestyle on physical and mental wellbeing: social distancing from healthy living. *Frontiers in Public Health*, 11, 1265814.
24. Hu G., Tuomilehto J., Borodulin K., Jousilahti P (2007) . The joint associations of occupational, commuting, and leisure-time physical activity, and the Framingham risk score on the 10-year risk of coronary heart disease. *Eur Heart J*, 492-498.

25. Huffman, S., & Szafron, M. (2017). Social correlates of leisure-time sedentary behaviours in Canadian adults. *Preventive Medicine Reports*, 5, 268-274.
26. Iso-Ahola, S. E., & Baumeister, R. F. (2023). Leisure and meaning in life. *Frontiers in psychology*, 14, 1074649.
27. Kazemi, A., Soltani, S., Aune, D., Hosseini, E., Mokhtari, Z., Hassanzadeh, Z., ... & Akhlaghi, M. (2024). Leisure-time and occupational physical activity and risk of cardiovascular disease incidence: a systematic-review and dose-response meta-analysis of prospective cohort studies. *International Journal of Behavioral Nutrition and Physical Activity*, 21(1), 45.
28. Kohl III, H. W., Cook, H. D., & Committee on Physical Activity and Physical Education in the School Environment. (2013). Physical activity, fitness, and physical education: Effects on academic performance. In *Educating the student body: Taking physical activity and physical education to school*. National Academies Press (US).
29. Langhammer, B., Bergland, A., & Rydwick, E. (2018). The importance of physical activity exercise among older people. *BioMed research international*, 2018, 7856823.
30. Lo, K. Y., Wu, M. C., Tung, S. C., Hsieh, C. C., Yao, H. H., & Ho, C. C. (2017). Association of school environment and after-school physical activity with health-related physical fitness among junior high school students in Taiwan. *International journal of environmental research and public health*, 14(1), 83.
31. Lindwall, M., Larsman, P., & Hagger, M. S. (2011). The reciprocal relationship between physical activity and depression in older European adults: a prospective cross-lagged panel design using SHARE data. *Health Psychol*, 30(4), 453-462.
32. Liu, Y., Feng, Q., Tong, Y., & Guo, K. (2023). Effect of physical exercise on social adaptability of college students: chain intermediary effect of social-emotional competency and self-esteem. *Frontiers in Psychology*, 14, 1120925.
33. Liu, R., Menhas, R., & Saqib, Z. A. (2024). Does physical activity influence health behavior, mental health, and psychological resilience under the moderating role of quality of life?. *Frontiers in Psychology*, 15, 1349880.
34. Mahindru, A., Patil, P., & Agrawal, V. (2023). Role of physical activity on mental health and well-being: A review. *Cureus*, 15(1).
35. McArdle, W. D., Katch, F. I., & Katch, V. L. (2006). *Essentials of exercise physiology*. Lippincott Williams & Wilkins.
36. Muscella, A., Stefano, E., & Marsigliante, S. (2020). The effects of exercise training on lipid metabolism and coronary heart disease. *American Journal of Physiology-Heart and Circulatory Physiology*, 319(1), H76-H88.
37. Neumann, R. J., Ahrens, K. F., Kollmann, B., Goldbach, N., Chmitorz, A., Weichert, D., ... & Matura, S. (2022). The impact of physical fitness on resilience to modern life stress and the mediating role of general self-efficacy. *European archives of psychiatry and clinical neuroscience*, 272(4), 679-692.
38. Niemiro, G. M., Rewane, A., & Algotar, A. M. (2023). Exercise and fitness effect on obesity. In StatPearls [Internet]. StatPearls Publishing.
39. Owen, N., Sparling, P. B., Healy, G. N., Dunstan, D. W., & Matthews, C. E. (2010, December). Sedentary behavior: emerging evidence for a new health risk. In *Mayo Clinic Proceedings* (Vol. 85, No. 12, p. 1138).
40. Paffenbarger, R. S. Jr., Kampert, J. B., & Lee, I. M. (1997). Physical activity and health of college men: Longitudinal observations. *International Journal of Sports Medicine*, 18, 200-203.
41. Park, J. H., Moon, J. H., Kim, H. J., Kong, M. H., & Oh, Y. H. (2020). Sedentary lifestyle: overview of updated evidence of potential health risks. *Korean journal of family medicine*, 41(6), 365.
42. Pinheiro, M. B., Oliveira, J., Bauman, A., Fairhall, N., Kwok, W., & Sherrington, C. (2020). Evidence on physical activity and osteoporosis prevention for people aged 65+ years: a systematic review to inform the WHO guidelines on physical activity and sedentary behaviour. *International Journal of Behavioral Nutrition and Physical Activity*, 17(1), 150.
43. Pinckard, K., Baskin, K. K., & Stanford, K. I. (2019). Effects of exercise to improve cardiovascular health. *Frontiers in cardiovascular medicine*, 6, 69.
44. Rodrigues, P. M. F., & Delerue-Matos, A. (2025). The effect of social exclusion on the cognitive health of middle-aged and older adults: a systematic review. *Archives of Gerontology and Geriatrics*, 130, 105730.
45. Shen, Y., & Zhou, P. (2024). Technological anxiety: Analysis of the impact of industrial intelligence on employment in China. *Chinese Journal of Population, Resources and Environment*, 22(3), 343-355.
46. Shores, K. A., & West, S. T. (2010). Pursuing leisure during leisure-time physical activity. *Journal of Physical Activity and Health*, 7(5), 685-694.
47. Sisson, S. B., Camhi, S. M., Church, T. S., Martin, C. K., Tudor-Locke, C., Bouchard, C., ... & Katzmarzyk, P. T. (2009). Leisure time sedentary behavior, occupational/domestic physical activity, and metabolic syndrome in US men and women. *Metabolic syndrome and related disorders*, 7(6), 529-536.
48. Simpson, S. (1989). The effects of participation in P.E. activities upon health related physical fitness. *Journal of Human Movement Studies*, 17 (4) : 153-163.
49. Slattery, M. L., & Jacobs D. R. (1987). The inter-relationships of physical activity, Physical fitness and body measurements. *Medicine and Science in Sports Exercise*. 19 (6) : 564-569
50. Stebbins, R. A. (2015). *Serious leisure: A perspective for our time* (paperback edition). New Brunswick: Transaction Publishers.

51. Su, M. J., Ho, C. H., & Yeh, C. C. (2024). Association of alcohol consumption, betel nut chewing, and cigarette smoking with mortality in patients with head and neck cancer among the Taiwanese population: A nationwide population-based cohort study. *Cancer Epidemiology*, *89*, 102526.
52. Su, J., Wang, Y., Liu, H., Zhang, Z., Wang, Z., & Li, Z. (2025). Investigating the factors influencing users' adoption of artificial intelligence health assistants based on an extended UTAUT model. *Scientific Reports*, *15*(1), 18215.
53. Sullivan, A. N., & Lachman, M. E. (2017). Behavior change with fitness technology in sedentary adults: a review of the evidence for increasing physical activity. *Frontiers in public health*, *4*, 222909.
54. Szeszák, B. M., Kerékjártó, I. G., Soltész, L., & Galambos, P. (2025). Industrial revolutions and automation: Tracing economic and social transformations of manufacturing. *Societies*, *15*(4), 88.
55. Tian, D., & Meng, J. (2019). Exercise for prevention and relief of cardiovascular disease: prognoses, mechanisms, and approaches. *Oxidative medicine and cellular longevity*, *2019*(1), 3756750.
56. Toros, T., Ogras, E. B., Toy, A. B., Kulak, A., Esen, H. T., Ozer, S. C., & Celik, T. (2023). The impact of regular exercise on life satisfaction, self-esteem, and self-efficacy in older adults. *Behavioral Sciences*, *13*(9), 714.
57. Turecek, S., Brymer, E., & Rahimi-Golkhandan, S. (2025). The relationship between physical activity environment, mental wellbeing, flourishing and thriving: A mixed method study. *Psychology of sport and exercise*, *76*, 102769.
58. U.S. Department of Health and Human Services. (1996). *Physical Activity and Health: A Report of the Surgeon General*. Atlanta, GA.
59. World Health Organization (2010). *Global status report on noncommunicable diseases*, P1, 116-117.
60. World Health Organization. (2024, June 26). *Physical activity* [Fact sheet]. <https://www.who.int/news-room/fact-sheets/detail/physical-activity>