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Title page

Relationship between sufficient leisure-time physical activity and happiness: Age stratification perspective

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Abstract

Background: Leisure-time physical activity (LTPA) has been frequently reported as a method to improve happiness. However, the effects of LTPA sufficiency and age differences are less discussed in the literature. The aim of this study was to examine the relationship between LTPA sufficiency and happiness based on an age stratification perspective.

Methods: A total of 16,412 data from the national physical activity survey was used for this study. Multivariate logistic regression analyses were applied to examine the odds ratio of LTPA sufficient population on happiness.

Results: LTPA sufficient young adults (25-29 years old) performed 2.5 to 3 times the odds on the happiness while compare to insufficient group. However, an unexpected result indicated the negative association between sufficient LTPA and happiness in 35-39 years old men. Intrapersonal differences (e.g. achievement goals and motivational level) and the environment (social context) might play a fundamental role in the LPTA-happiness relationship.

Conclusions: The present study argued that the context of LTPA and psychological status should be clearly addressed in terms of its benefit on happiness.

Trial registration: This study was approved by the Institutional Review Board of Chung Shan Medical University Hospital (CRREC-104-015), registered on 18th Oct. 2016.

Background

Pursuing a state of happiness is an essential goal of life. It related to one's thoughts and feelings that comprise the subjective evaluations of his/her life experiences [1,2]. It is also contributing to one's self-development and social progress. Researches indicated that people who are happier are more likely to be productive and creative at work, more prosocial, healthier, lived longer, and have better relationships [3,4,5]. Today, however, mental illness has captured a leading cause of sickness absence and work incapacity in most developed countries [6]. Depression, anxiety, and stress-related illness are common threats to one's health or causes functional disability [7]. Unfavorable mental conditions are not only damaging an individual's health and social function, but also gradually impairing social-economic development, and creating public problems. Fortunately, these psychiatric problems are usually treatable; in some cases, they may be preventable [8].

Leisure-time physical activity (LTPA) is one of the significant factors negatively associated with physiological diseases and mental disorders. A meta-analysis on the relationship between LTPA and mental health found that physical activity reduces depression and anxiety in non-clinical populations [9]. Besides, LTPA has been used as one of the approaches to enhance mental or physical conditions. Also, LTPA can be an effective antidepressant treatment for mild to moderate depression compared to traditional medicine and psychotherapy [10]. In other words, LTPA plays an essential role in improving one's health, life qualities, and satisfaction.

In addition, many studies found that there is a positive association between LTPA and happiness. For example, emerging adults (18-25 years old) who were more physically active tended to be happier than those who were physically inactive [11]. Similarly, physically active

participants had a higher likelihood to report "very happy" in their daily life [12]. A cohort study [13] analyzed the long-term effects of LTPA on happiness and indicated that people who continue participating in LTPA for 2 and 4 years could reduce the likelihood of unhappiness compare to those who were physically inactive. Recently, Zhang and Chen [14] systematically reviewed 23 studies on the association between physical activity and happiness, found that as little as 10 minutes of physical activity per week or one time of doing physical activity per week can increase one's level of happiness. In general, empirical studies supported that engaged in LTPA can improve happiness and quality of life [13,15,16,17].

However, to the best of our knowledge, the research on the association between LTPA and happiness has seldom examined the variation of LTPA on happiness in terms of its frequency, intensity, time, and type (FITT principle), based on the American Colleges of Sport Medicine (ACSM) guidelines. For example, many studies have partly focused on the frequency [12,18,19], durations [17,20,21], and intensity [22] respectively on the relationship between LTPA and happiness. Few studies have measured LTPA by the specific guidelines, none of them discussed on LTPA sufficiency. Although several studies attempted to explore the association between LTPA and happiness, the association between sufficient LTPA and happiness is still unclear. According to the guidelines of the Sports Administration of Taiwan, it is recommended that participants in LTPA should be at least 3 times for more than 30 minutes of moderate to vigor-intensity (heart rate reached 130 bpm or feeling breath quickly and sweating) per week.

Furthermore, although researches on the association between LTPA and happiness produced many meaningful results, these studies have seldom examined the differences of age on this relationship. Specifically, an adult's mental health development is related to two factors across the lifespan [23]. First, personal goals act as guideposts for wellbeing and mental health.

Second, self-regulation plays an essential role that processes governing goal pursuit and adjustment. These two factors decide how individuals evaluate how they are doing in life and recognize the fact (such as time and energy are always limited) across their life development, eventually reflex to their life satisfaction. On the other hand, indeed, several studies have found that the relationship between happiness and age is presented by a U-shape pattern [24,25]. The descent of desires on infeasible aspirations in middle-ages, also the individual adaption to personal strengths and weaknesses, are the common reasons for this result [26]. Although Hyde and colleagues [27] have reviewed the characteristics of LTPA and happiness across the lifespan, the associations between LTPA and happiness have never discussed from the age perspective in adulthood.

Therefore, the present study aims to examine the relationship between sufficient and insufficient LTPA and happiness based on an age stratification perspective among Taiwanese adults. The research data came from a nationwide survey in 2018.

Materials and Methods

Data source

The data from Taiwanese physical activity participation annual survey in 2018 was applied. The data includes a nationwide survey of physical activity behaviors, self-reported health status, personal characteristics, and self-evaluations (includes happiness). Data collection was accomplished by the Institute for Public Opinion, Shih-Hsin University. A computer-assisted telephone interview (CATI) was applied from August to October 2018. Trained and experienced interviewers have employed in the CATI to ensure the quality of data collection.

All data collections followed by stratified proportional sampling. The sampling population came from citizens aged over 13 years and stratified by 22 districts of the country. The sample consisted of 25,654 residents in total, with sampling errors of 3% and confidence (CI) of 95%, which allowed for achieving a sufficient sample size and statistical power. Age was first filtered through the database to ensure the adulthood participants have included in the analysis, followed by the skewness and kurtosis assessment. Outliers of each relevant variables have excluded. Finally, 16,412 of data were included with age between 25 and 64 years old [27]. Due to the telephone-based survey, participants were fully informed about the objective, procedure, and content of this survey. The oral consent has given before the interview. All relevant information has contained by the de-identified secondary dataset and has released for public research purposes. This study was approved by the Institutional Review Board of Chung Shan Medical University Hospital (CRREC-104-015), registered on 18th Oct. 2016.

Data collection

Variables such as gender, age, education, occupation, self-reported health status, height, weight, body mass index (BMI), and obese status of participants have employed for the demographic assessment. The cut-off points of BMI were suggested by the Health Promotion Administration, Ministry of Health, and Welfare of Taiwan. It includes underweight ($BMI < 18.5 \text{ kg/m}^2$), normal weight ($18.5 \leq BMI < 24 \text{ kg/m}^2$), overweight ($24 \leq BMI < 27 \text{ kg/m}^2$) and obese ($BMI \geq 27 \text{ kg/m}^2$).

Measure of LTPA

In this study, sufficient LTPA has assessed by a series of questions during the CATI.

First, the participants were asked to answer their current LTPA participation. The question was like "Have you taken part in any LTPA in the past month?" Positive respondents then have asked for their participating frequency and duration, such as "How many times do you participated in LTPA per week?"; "How many minutes do you usually spend in one time?" The intensity assessment of LTPA referred to participants' self-reported breathing rate and sweating. The question was listed as, "When you are doing LTPA, you usually feel...." Then the respondents were asked to answer one of the structured options such as "no changes on my breath and sweat," "I breathe faster but no sweating," "I breathe normally but sweating," "I breathe quickly and sweating." Participants who reported he/she usually breathe quickly and sweating considered achieved moderate-intensity. Thus, based on the LTPA participating frequency, duration, and intensity, respondents were dichotomized into sufficient and insufficient LTPA groups.

Measure of happiness

A single item question "Taking all things together, how happy would you say you are?" was used to assess the happiness status of participants [28]. Same approaches have previously applied [15,16,18,29,30,31,32] and has been validated by studies [33,34]. The response scale listed from 1 (very unhappy) to 5 (very happy). Furthermore, all respondents are dichotomized into two groups as happy (i.e., very happy, happy, and fair) and unhappy (i.e., unhappy and very unhappy), according to Wang's approach [35].

Statistical analysis

Data analyses were performed using IBM SPSS software 25. Student's *t*-test and chi-

square test were used to analyze the differences in participants' demographic characteristics. Besides, two times of multivariate logistic regression analyses were conducted, included general and age stratification populations, to determine the odds ratios (ORs) of sufficient LTPA to happiness. All regression models in our analysis are followed by the confounding factor adjustment to avoid individual influences. The present study calculated the ORs with 95% CIs for happiness. All data are expressed as means \pm standard deviation (SD) or frequency percentage. The significance level adopted to reject the null hypothesis was $P < 0.05$.

Results

The demographic characteristics of the research population have shown in Table 1. 16,412 of data were employed and dichotomized into groups regarding their happiness status. More than 87% of participants are classed into the happy group and demonstrated higher female rate (53.51%), lower obese rate (15.47%), higher educated (44.33% in college), lower jobless rate (4.02%), and nearly 80% self-reported in excellent or good health. Except for the pooled-age, the significant differences have found in all of the demographic data between the two groups.

Table 2 presents the cross-analysis between sufficient LTPA and happiness status. In total, 27.7% of the happy group and 18.6% of the unhappy group achieved sufficient LTPA. Men contributed higher sufficient LTPA participating rate in both happy and unhappy group. Significant differences have found ($p < .001$) in all comparisons. Table 3 revealed the preliminary results of multivariate logistic regression without age stratification. The results indicated that sufficient LTPA groups are around 1.5 to 2 times the odds of the happiness of insufficient LTPA groups.

Table 4 conducted a series of multivariate logistic regressions to perform the age

stratification. The result indicated that LTPA sufficient men respondents are more likely to be happy than LTPA insufficient group in age 25-29 (OR: 2.90), 45-49 (OR: 1.80), and 50-54 (OR: 2.66). Moreover, women age 25-29 (OR: 2.66), 35-39 (OR: 4.03), 40-44 (OR: 2.45), 45-49 (OR: 3.43), and 60-64 (OR: 2.01) performed more than 2 times the odds on the happiness of LTPA insufficient group. Surprisingly, men in 35 to 39 years old performed the OR bellows 1 (0.54; p: .001). The results indicated that individuals who engaged sufficient LTPA in this particular age are only 50% of odds on happiness while comparing to the insufficient group.

Discussion

The present study aimed to analyze the associations between sufficient LTPA and happiness among Taiwanese adults in terms of age differences. A representative database has used for the multivariate logistic regression analysis from an age stratification perspective. Although our results generally supported the benefit of sufficient LTPA on happiness, statistic evidence in some ages has not observed. This might be correlated with individual differences and social contexts influences. Our findings provided new information and insights to depict the form of the LTPA-happiness relationship through the adulthood in Taiwan.

First, pooled LTPA sufficient populations performed 1.5 to 2 of odds on happiness than the insufficient group, particularly for women. Our result supports previous researches from a critical perspective on LTPA sufficiency [11,13,14,18,20,22]. Second, from the age perspective, the influential ORs have found in both genders age 25 to 29 (OR 2.90 for men, 2.66 for women). This indicated that around 2.5 to 3 times the odds of happiness could be found through a sufficient LTPA participation in such ages. Young adults are typical with the likelihood of

engaging in regular exercise and increasing their life satisfaction and happiness [36].

Third, although some significant associations could not be found, the results performed the fluctuations of odds on happiness for sufficient LTPA across adulthood. For example, men had the highest OR (2.90) in 25-29 years old, followed by a descending trend until age 35-39 years (OR = 0.54), then ascended to the next peak in age 50-54 years (OR=2.66). The ORs after 54 years old became slack, and no significance was found. From a social-economic view, Taiwanese men commonly play an essential role in family economics. Men in 30 to 40 years old are usually facing problems such as declining job prospects [37], the rise of precarious work [38], work-family conflict [39]. The burdens and the desires for infeasible aspirations sometimes make their life frustrated [26]. Also, these adverse experiences are commonly limiting one's leisure life and creating problems [40].

Moreover, men's odds ratio in age 35-39 years (0.54) indicated that LTPA sufficient individuals have only half odds on happiness compare to insufficient individuals. Recently, the 3×2 achievement goal model [41] was applied to the LTPA setting [42]. Their results pointed out that the self-avoidance goal negatively predicted happiness and mediated by dispositional self-control. Pre-middle age men could be facing the same issue. For example, a man who is regularly participating in LTPA to avoid fitness decline or to avoid losses body shape might tally with the scenario. Barriers such as prolong working hours, taking care of children, and pre-occupied with business pressure could impact his dispositional self-control then causes a lower level of happiness [43].

On the other hand, women performed a waved trend with 5 significant odds across adulthood. All of them contributed more than 2 times of odds on the happiness while compare with insufficient group. Two declines have observed between ages 30-34 and 50-59, although

they did not reach the significant. The happiness of middle-aged women is related to their health status, financial distress, social support, psychological factors (e.g., self-esteem, positive thinking, or self-fulfillment) [44]. The variety of these individualized factors can be huge. Those adverse effects, such as health status and quality of life, might mitigate the benefit of LTPA [45]. Also, on average, Taiwanese women facing the parameter of menopausal symptoms after 50 years old [46]. Physical changes and improper coping strategy significantly decrease quality of life, and also reduce their general life satisfaction [47].

Therefore, although many types of research have indicated the benefit of LTPA on happiness, the present study provides different arguments. Indeed, the LTPA-happiness relationship seems clear from a general perspective. Meaningful benefits have also found in our results, particularly for women. However, the relationship in some ages remains unclear. Intrapersonal differences and social contexts may influence the benefits of LTPA on happiness. Also, psychological status such as achievement goals, motivational level, dispositional self-control should be further investigated.

The strength of the present study was using representative data for analysis. However, there are still some limitations should be addressed. First, we used a single-item question to evaluate participants' general perception of happiness. Although it has been supported by many kinds of research, however, it should consider that the component of happiness may be comprised of the different aspects of life, such as psychological, social, physical, and spiritual happiness. Further, although we have controlled the confounding variables during our analyses, we suggest future studies should include the multi-dimensional measurement of happiness. Moreover, because the present study adopted a cross-sectional study design, a cause-and-effect relationship cannot be guaranteed. Future studies may adopt a longitudinal design to

understand the cause and effect relationship between LTPA and happiness. Alternatively, use a qualitative design to understand sufficient LTPA-happiness relationship.

Conclusions

Based on the LTPA sufficiency, the present study provided that: First, women are more beneficial populations in LTPA-happiness relationships across adulthood. Second, men could be struggling against their achievement goals and motivational level while engaging sufficient LTPA, thus decrease their happiness level. Last, especially after middle age, the social context (environment), health and psychological status (intrapersonal factors) play fundamental roles in the LTPA-happiness relationship.

Abbreviations

ACSM, American Colleges of Sport Medicine; BMI: body mass index; CATI: computer-assisted telephone interview; CI: confidence interval; LTPA: leisure-time physical activity; OR: odd ratio; SD: standard deviation

Declarations

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Availability of data and materials

The datasets used and/or analyzed during the current study are not publicly available due to confidentiality but are available from the corresponding author on reasonable request.

Authors' contributions

PFL and CCH participated in the design, conducted the statistical analyses, interpreted the data, and drafted the manuscript. FJHL supervised the study, assisted in data interpretation, and critically reviewed the manuscript. DLG and YHC helped in conducting the study and revising the manuscript. YHK and CYT helped to manage and analyze the data.

All authors read and approved the final manuscript.

Ethics approval and consent to participate

This study was approved by the Institutional Review Board of Chung Shan Medical University Hospital (CRREC-104-015), registered on 18th Oct. 2016.

Consent for publication

Not applicable.

Competing interests

The authors declare that they have no competing interests.

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