

fizjoterapia polska



POLISH JOURNAL OF PHYSIOTHERAPY

OFICJALNE PISMO POLSKIEGO TOWARZYSTWA FIZJOTERAPII

THE OFFICIAL JOURNAL OF THE POLISH SOCIETY OF PHYSIOTHERAPY

NR 1/2024 (24) KWARTALNIK ISSN 1642-0136

**Ocena czynników wpływających na skuteczność
terapii integracji sensorycznej u dzieci
w wieku przedszkolnym i wczesnoszkolnym**

**Assessment of factors influencing the
effectiveness of sensory integration therapy
in preschool and early school-aged children**



Praca fizjoterapeuty z osobami niepełnosprawnymi intelektualnie
Physiotherapist's work with intellectually disabled individuals

ZAMÓW PRENUMERATE!

SUBSCRIBE!

www.fizjoterapiapolska.pl

www.djstudio.shop.pl

prenumerata@fizjoterapiapolska.pl





XV Jubileuszowe Sympozjum Fizykodiagnostyki i Fizjoterapii Stomatologicznej i Medycznej - "Stomatologia interdyscyplinarna"



VI Konferencja CRANIA „Konsensus w diagnostyce
i fizjoterapii stawów skroniowo-żuchwowych”

VI Zachodniopomorskie Sympozjum
Młodych Naukowców

Sesja Naukowa Polskiego Towarzystwa
Studentów Stomatologii



PTSS

Polskie Towarzystwo
Studentów Stomatologii
Szczecin

23-25.05.2024 R.

"VIENNA HOUSE AMBER BALTIC"
PROMENADA GWIAZD 1,
MIĘDZYZDROJE

TEMATYKA

- BIOMATERIAŁY WE WSPÓŁCZESNEJ MEDYCYNIE I STOMATOLOGII;
- ZABURZENIA CZYNNOŚCIOWE UKŁADU RUCHOWEGO NARZĄDU ŻUCIA;
- BIOMECHANIKA UKŁADU RUCHOWEGO I STOMATOGNATYCZNEGO; ORTOPODLOGIA;
- NOWOCZESNA DIAGNOSTYKA BIOCHEMICZNA;
- DIETETYKA;
- PSYCHOLOGICZNE I SOCJOEKONOMICZNE ASPEKTÓW NAUK O ZDROWIU

ORGANIZATORZY

- Zakład Propedeutyki, Fizykodiagnostyki i Fizjoterapii Stomatologicznej Pomorskiego Uniwersytetu Medycznego w Szczecinie;
- Sekcja Fizykodiagnostyki i Fizjoterapii Stomatologicznej Polskiego Towarzystwa Fizjoterapii;
- Fizjoterapia i Klinika Stomatognatyczna w Krakowie;
- szczeciński oddział Polskiego Towarzystwa Studentów Stomatologii

KONTAKT

91 466 16 73

<https://sympozjumfizyksto.m.wixsite.com/sympozjum>



**PATRONAT
HONOROWY
I MEDIALNY**



PATRONAT HONOROWY
MARSZAŁKA WOJEWÓDZTWA
ZACHODNIOPOMORSKIEGO
OLGIERDA GEBLEWICZA





1st Occupational Therapy Europe Congress

Future-Proofing Occupational Therapy

15-19 October 2024, Kraków

Szanowni Państwo!

W dniach 15-19 października 2024 roku w Centrum Kongresowym ICE Kraków, odbędzie się 1 Kongres Occupational Therapy Europe.

Kongres zgromadzi około 1000 Uczestników z całego świata – praktyków oraz naukowców, co obrazuje zainteresowanie tematyką proponowaną podczas obrad, czyli terapią zajęciową. Terapia zajęciowa to prężnie rozwijająca się dyscyplina, stanowiąca jeden z elementów szeroko rozumianej rehabilitacji. Terapeuci zajęciowi pracują z osobami zmagającymi się z różnymi niepełnosprawnościami, chorobami, zaburzeniami psychicznymi, osobami wykluczonymi społecznie, a także osobami zdrowymi w zakresie poprawy ich funkcjonowania i jakości życia. Terapeuta zajęciowy jest partnerem fizjoterapeuty w procesie zmierzającym do pełnej rehabilitacji pacjenta.

Serdecznie zapraszamy Państwa do udziału w tym niezwykłym wydarzeniu w charakterze uczestników lub wystawców. Praca z pacjentami wymaga często stosowania narzędzi i technologii wspierających rehabilitację, co daje ogromne możliwości do zaprezentowania swojego produktu/usługi szerokiemu gronu odbiorców nie tylko z Europy, ale i całego świata.

Więcej szczegółów pod linkiem: <https://ot-europe2024.com>

Bądźcie z nami w tym szczególnym dla polskiej terapii zajęciowej i rehabilitacji czasie!

XVI Konferencja Naukowa Polskiego Towarzystwa Fizjoterapii

6-7 grudnia 2024 r.

Pabianice



<https://16konferencja.pl>

Identification of recreational cycling training dose as an effective physical therapy to elicit changes into active lifestyle

Wyznaczenie optymalnej dawki treningu rekreacyjnego na rowerze jako efektywnej fizjoterapii prowadzącej do zmian w aktywnym trybie życia

**Yudik Prasetyo^{1(A,F)}, Sumaryanto^{1(A,G)}, Abdul Alim^{2(B,D)}, Guntur^{3(B,D)},
Jamatul Shahidah Shaari^{4(B,C,D)}, Nur Asmidar Halim^{4(B,F)}, Krisnanda Dwi Apriyanto^{1(A,B,D,E)},
Rizki Mulyawan^{1(A,B,C,E)}**

¹Department of Sports Science, Faculty of Sport and Health Sciences, Universitas Negeri Yogyakarta, Indonesia

²Department of Sports Coaching Education, Faculty of Sport and Health Sciences, Universitas Negeri Yogyakarta, Indonesia

³Department of Physical Education, Faculty of Sport and Health Sciences, Universitas Negeri Yogyakarta, Indonesia

⁴Department of Sports Science, Faculty of Sports Science and Recreation, Universiti Teknologi Mara, Malaysia

Abstract

This study aims to determine the relationship of living habits during the new normal period with (1) body composition and (2) blood oxygen levels after cycling while wearing a mask. This research is a multicenter study between Indonesia and Malaysia, with the data presented here being specifically from the DI Yogyakarta region in Indonesia, involving an analytical observational study using a cross-sectional approach. The study included 71 research subjects. The instruments used to collect data were fitness behavior during the pandemic (exercise frequency and duration), anthropometric and oxygen saturation measurement after cycling during pandemic. Body composition was determined using the BMI formula, involving height and weight. Oxygen saturation during cycling was measured using the Pulse Oximeter FOX-1(N) by Elitech Technovision. The largest percentage of cycling is twice a week (42.25%), followed by three, one, fifth and fourth times a week. The majority of participants cycled for 120 minutes (35.21%), followed by durations of 180 minutes, 60 minutes, 30 minutes, and so on. Oxygen saturation data shows that most subjects have oxygen saturation of 98% (47.8% of respondents), none of them have 100%, but 97% saturation, 96% occupying the second and third distributions. From the primary data obtained in Indonesia, only oxygen saturation and cycling duration showed a highly significant relationship ($p = 0.009$), while other variables, such as BMI and cycling frequency, did not exhibit a significant correlation. It can be concluded that a significant relationship exists between exercise duration, specifically cycling, and oxygen saturation in Indonesian subjects.

Keywords

cycling, physical activity, fit behavior, body composition, oxygen saturation, exercise and pandemic

Streszczenie

Celem tego badania jest określenie związku między nawykami żywymi w okresie nowej normalności a (1) składem ciała oraz (2) poziomem tlenu we krwi po jeździe na rowerze w masce. Badanie to jest studium wielośrodkowym pomiędzy Indonezją a Malezją, przy czym dane prezentowane tutaj dotyczą specyficznie regionu DI Yogyakarta w Indonezji i obejmują badanie obserwacyjne analityczne z wykorzystaniem podejścia przekrojowego. W badaniu wzięło udział 71 osób badanych. Instrumenty użyte do zbierania danych to zachowania związane z kondycją fizyczną podczas pandemii (częstotliwość i czas trwania ćwiczeń), pomiary antropometryczne oraz nasycenie tlenem po jeździe na rowerze w czasie pandemii. Skład ciała został określony za pomocą wzoru BMI, uwzględniającego wzrost i wagę. Nasycenie tlenem podczas jazdy na rowerze mierzono przy użyciu pulsoksymetru FOX-1(N) firmy Elitech Technovision. Największy odsetek osób jeżdżących na rowerze to dwa razy w tygodniu (42,25%), za którymi plasują się trzy, jeden, piąty i czwarty raz w tygodniu. Większość uczestników jeździła na rowerze przez 120 minut (35,21%), a następnie przez 180 minut, 60 minut, 30 minut itd. Dane dotyczące nasycenia tlenem pokazują, że większość badanych ma nasycenie tlenem na poziomie 98% (47,8% respondentów), żaden z nich nie osiągnął 100%, ale 97% nasycenia, 96% zajmuje drugie i trzecie miejsce w dystrybucji. Z pierwotnych danych uzyskanych w Indonezji tylko nasycenie tlenem i czas trwania jazdy na rowerze wykazały bardzo istotny związek ($p=0,009$), podczas gdy inne zmienne, takie jak BMI i częstotliwość jazdy na rowerze, nie wykazały istotnej korelacji. Można zatem wnioskować, że istnieje istotny związek między czasem trwania ćwiczeń, a konkretnie jazdą na rowerze, a nasyceniem tlenem u indonezyjskich badanych.

Słowa kluczowe

jazda na rowerze, aktywność fizyczna, zachowania związane z kondycją, skład ciała, nasycenie tlenem, ćwiczenia i pandemia

Introduction

Cycling activities have become a prominent lifestyle change for many people during the new normal. Physical activities, such as sports, offer numerous benefits, including maintaining health, preventing disease, and reducing obesity. However, the reason why cycling became popular is not known for sure whether it is done because people understand the benefits of exercise or they just do it by following trends without knowing the effects and don't even care about the benefits of cycling as the new normal habit. The Covid-19 pandemic has hit Indonesia for almost 2 years. Most people feel bored because they have to be at home, therefore people are enthusiastic about doing physical activity even though they are still in a pandemic condition. New normal is a new term created by the government as an effort to start good and healthier habits after the pandemic. Doing regular physical activity is one of the elements that shows the application of a healthy lifestyle. Forming new habits will certainly affect lifestyle and physical activity during the new normal. One of the new habits during the pandemic is always wearing a mask when doing physical activities. However, this habit still has pros and cons. People who cycle during the new normal period must be more careful. Cyclists can face high risks. The news about wearing a mask while cycling is considered dangerous is spread too much, even the Indonesian Medical Association (IDI) and WHO have different assumptions, causing confusion among the public. This has caused the public to become indifferent about wearing masks, thereby increasing the risk of Covid-19 cases. In addition, the news of cyclist deaths is also increasing due to the high duration and intensity of cycling, without considering their own capabilities. Based on that news, cycling-related deaths should be something to consider in order to exercise properly during the pandemic in accordance with the abilities of each individual. The American Heart Association and WHO recommends people to exercise at least 150 minutes as moderate training per week [1].

In Indonesia, cycling has become a trend among the community as an activity that is carried out every weekend. The lifestyle change accompanied by cycling activities in the

new normal has a positive impact on reducing the risk of contracting diseases during the pandemic [2, 3], one of them is a drastic increase in body weight or obesity [4]. Cycling activities have occurred as a result of social distancing for individuals engaging in outdoor activities, with a minimum distance of 1.5 meters between individuals [5]. On the other hand, the crowds that arise due to the large number of cyclists on the streets become an irony, this raises the question of whether cycling activities are done out of boredom at home, as a means to maintain health, or as a form of indifference towards Covid-19. This has become a significant question, so there's a need for identification regarding the phenomenon in society. So far, research on cycling habits is still limited, it's primarily limited to the types of bicycles owned by the majority of people [6–8], and it hasn't yet focused on investigating oxygen levels while cycling with a mask, as well as considerations for exercise duration and frequency.

On the other hand, the cycling habits of the community haven't been definitively understood. It's unclear whether people engage in this activity for its fitness benefits, do it without awareness of its effects, or simply disregard the impact of cycling habits during the new normal on their body composition. There's a need for in-depth identification to assess oxygen levels in the blood due to mask usage while cycling.

Methods

This research is part of a multicenter study between Indonesia and Malaysia. This article discusses the research findings in Indonesian especially Yogyakarta using an analytical observational method with a cross-sectional approach.

Research subjects

The description of the research subjects can be found in table 1, whereas the entire sample population is derived from Indonesia, utilizing random sampling technique, and the research is conducted in the Yogyakarta region. A total of 71 people were obtained with the criteria of being 18-69 years old, willing to participate voluntarily in data collection, and not currently injured or ill.

Table 1. Subject description in Indonesia

Categories	Mean ± SD
Age [years]	34.25 ± 15.03
Body height [cm]	165.11 ± 7.91
Body weight [kg]	65.36 ± 10.02
BMI	23.93 ± 3.10
Cycling duration [minutes]	106.05 ± 53.25
Saturation of oxygen [%]	97.30 ± 1.07
Cycling frequency [times]	2.43 ± 1.05

Research Instrument

The instrument used to collect data is anthropometric data and oxygen saturation measurements. Body composition is obtained through

the BMI (Body Mass Index) formula, which involves height and weight. Meanwhile, the oxygen saturation level during cycling is measured using the Pulse Oximeter FOX-1(N) by Elitech Technovision.

Data analysis

Data analysis techniques using quantitative descriptive analysis and correlation tests using Pearson Correlation.

Results

If examined more deeply, this study is focusing on three

components, that are frequency, cycling duration, and oxygen saturation. First, the description of cycling frequency can be found in table 4.2. From the table, it can be observed that the largest percentage of cycling frequency is twice a week, accounting for 42.25%, followed by 3 times, 1, 5, and 4 times a week.

Table 2. Cycling frequency

Frequency [time]	Distribution	%
1	12	16.90
2	30	42.25
3	20	28.17
4	4	5.63
5	5	7.04

After knowing the frequency of cycling, it is necessary to determine how much time the subjects spend cycling in one go or per session. The data can be observed in table 4.3,

where the largest percentage, 35.21%, corresponds to cycling for 120 minutes. Following that, it is 180 minutes, 60 minutes, 30 minutes, and so on.

Table 3. Cycling duration

Frequency [minutes]	Distribution	%
30	14	19.72
60	10	14.08
90	5	7.04
120	25	35.21
150	0	0
180	17	23.94

The next set of data pertains to the immediate collection of oxygen saturation data when resting after cycling. This means that at the time of data collection, the subjects still felt a rapid heartbeat and were sweating. According to Table 4.4, it

mentions that most subjects had an oxygen saturation of 98%. None of them had a 100% condition, but saturations of 97% and 96% ranked second and third.

Table 4. Oxygen saturation

Saturation [%]	Distribution	%
95	6	8.45
96	10	14.08
97	16	22.53
98	34	47.88
99	5	7.04
100	0	0

It is important to note the relationship between one variable and another, especially in the subject parameter. By using Pearson Correlation calculations to determine the relation between

variables, it was found that only oxygen saturation and cycling duration have a highly significant relation ($0.009 < 0.01$), while other variables do not show significant correlations.

Table 5. Correlation between variables

Variable	Sig. %
Saturation – Exercise Frequency	0.445
Saturation – Cycling Duration	0.009**
Saturation – BMI	0.762
Frequency – Cycling Duration	0.645
Frequency – BMI	0.875
Cycling Duration – BMI	0.284

Discussions

According to the study results, the majority's oxygen saturation levels after exercising during the pandemic remained within a safe range, between 95-99%, predominantly at 98%, without any falling below the threshold. Meanwhile, overall, cycling is still being done only twice a week on average, with an average duration of 100 minutes per session. Referring to the WHO recommendations, cycling should ideally be done three times a week [1], not twice. According to this study data, the duration of cycling is accepted because the recommendation from WHO is 150 minutes per week, but the frequency should be increased to three times a week to fully align with their guidelines. The study might not account for other physical activities that the subjects may be engaged in besides cycling, which could also contribute to their overall physical fitness.

The habit of cycling has been spreading again since the pandemic [6, 8]. People feeling bored at home have developed new habits while still following health protocols, choosing to cycle as it's well-suited for maintaining distance [5]. A recent study in Indonesia discusses the portrayal of cycling activities among the community and the types of bicycles preferred by many people. The study involved a total of 130 participants, divided into four groups (genres) of bicycle: BMX, Road Bike, Mountain Bike, and Trail. The research indicates that 50% of the subjects have a high interest in cycling as a sport, 48.46% (63 subjects) have a moderate interest in cycling, and the lowest category has a percentage of 1.54%. Meanwhile, among the four types of bicycles, road bikes play the most significant role with 62 respondents, followed by mountain bikes with 44 respondents, and BMX and trail bikes each having 12 respondents. So, it can be concluded that the road bike being the most trendy type among the community and the public's interest in cycling as a sport during the COVID-19 pandemic falls into the high category [7].

The oxygen saturation in each person varies, and there are many factors that influence it, one of which is that blood vessels in the body will gradually narrow, as well as other factors such as physical differences between individuals [9]. Therefore, in this study it can be seen that oxygen saturation does not affect a person's physical activity, because in each person's body the circulatory system and body functions are different. However, this is inversely proportional to evidence from one study which showed a decrease in oxygen saturation in obese women who did moderate intensity exercise [10]. Meanwhile, there are several factors that influence oxygen

saturation, including changes in HB levels, poor blood circulation in the body, and symptoms such as shivering or excessive movement.

The normal oxygen level typically ranges from 95 to 100% [11], indicating that organs such as the heart, lungs, and circulatory system are functioning properly. There are several steps to improve body saturation, including improving posture, exercising regularly, changing dietary habits, consuming zinc, practicing deep breathing exercises regularly, and enhancing air quality. Furthermore, one study indicates the influence of coffee consumption on increasing oxygen saturation when engaging in physical exercise [11]. The Lung Health Institute states that poor posture can have an impact on breathing. Slouching or other poor postures can reduce lung performance and capacity to absorb oxygen by up to 5% [12].

Exercise can increase lung capacity [13], maintaining body weight [14] and heart health [15, 16]. Indeed, the recommended amount of exercise is at least 30 minutes per day [1, 17]. Physical activity can reduce the risk of hypoxemia. The body needs a supply of nutrients and vitamins to stay healthy. Consume foods rich in antioxidants [18, 19] such as strawberries, blueberries, grapes, dates, oranges, and red beans. Food rich in antioxidants can help increase oxygen levels in the blood. Boost oxygen saturation by consuming iron. Iron is essential for forming red blood cells to carry oxygen throughout the body [11]. Foods containing iron include red meat and green vegetables. Improper breathing techniques can decrease blood oxygen levels by up to 20%. Breathing exercises can be done through yoga. When practiced regularly, Yoga can increase blood oxygen levels and promote physical and mental well-being. The mentioned ways to increase oxygen saturation can be beneficial in reducing symptoms such as fatigue, confusion, sweating, changes in nail color, and shortness of breath. This is based on the potential for a decrease in oxygen saturation in muscles after high-intensity or maximal exercise [10, 20].

From this study, it can be concluded that duration correlates positively with oxygen saturation levels, but this correlation does not apply to frequency and BMI. However, when considering long-term body adaptation, regular exercise frequency can have a significant impact on cardiovascular fitness [15, 21, 22], regular exercise can also improve strength and flexibility, contributing to overall physical fitness and well-being [23] physical exercise is closely related to the heart's ability to pump blood efficiently and circulate it throughout the body, it will increase the oxygen level in the blood for the better condition.

Conclusion

A highly significant correlation was found between exercise duration and oxygen saturation in subjects in Indonesia after cycling, while frequency and BMI showed no significant correlation. This research suggest that increasing cycling behaviour potentially improve cardiovascular system step by step after excessive sedentary lifestyle.

Adres do korespondencji / Corresponding author

Rizki Mulyawan

E-mail: rizkimulyawan@uny.ac.id

Piśmiennictwo/ References

1. World Health Organization. WHO Guidelines on physical activity, sedentary behaviour. 2020.
2. Aguilar-Arevalo AA, Brown BC, Bugel L, et al. Significant excess of electronlike events in the MiniBooNE short-baseline neutrino experiment. *Physical review* Epub ahead of print 2018. DOI: 10.1103/PhysRevLett.121.221801.
3. Booth FW, Roberts CK, Laye MJ. Lack of exercise is a major cause of chronic diseases. *Compr Physiol*. Epub ahead of print 2012. DOI: 10.1002/cphy.c110025.
4. Kolovos S, Jimenez-Moreno AC, Pinedo-Villanueva R, et al. Association of sleep, screen time and physical activity with overweight and obesity in Mexico. *Eating and Weight Disorders*. Epub ahead of print 2021. DOI: 10.1007/s40519-019-00841-2.
5. Blocken B, Malizia F, van Druenen T, et al. Towards aerodynamically equivalent COVID19 1.5 m social distancing for walking and running. *Urban Physics*.
6. Devin D, Pranata G, Susanto J. ANALISIS EFEKTIVITAS LAJUR KHUSUS SEPEDA PADA KAWASAN TOMANG – CIDENG TIMUR. *JMTS: Jurnal Mitra Teknik Sipil*. Epub ahead of print 2021. DOI: 10.24912/jmts.v0i0.10507.
7. Fatoni RA, Suroto S, Indahwati N. Pengaruh aktivitas fisik program gross motor skill terhadap indeks massa tubuh dan tingkat kebugaran jasmani. *Multilateral : Jurnal Pendidikan Jasmani dan Olahraga*; 20. Epub ahead of print 2021. DOI: 10.20527/multilateral.v20i1.9539.
8. Stefanus S, Carina N. URBAN BIKE HUB CISAUK. *Jurnal Sains, Teknologi, Urban, Perancangan, Arsitektur (Stupa)*. Epub ahead of print 2021. DOI: 10.24912/stupa.v3i1.10769.
9. Savoia C, Schiffrin EL. Hypertensive vascular disease. In: *Hypertension*. 2013. Epub ahead of print 2013. DOI: 10.2217/EBO.12.172.
10. Coli C, Sari GM, Rejeki PS. Acute Moderate Intensity Exercise Decreases Oxygen Saturation In Obese Women. *STRADA Jurnal Ilmiah Kesehatan*. Epub ahead of print 2020. DOI: 10.30994/sjik.v9i2.302.
11. Ruiz-Moreno C, Lara B, Brito de Souza D, et al. Acute caffeine intake increases muscle oxygen saturation during a maximal incremental exercise test. *Br J Clin Pharmacol*. Epub ahead of print 2020. DOI: 10.1111/bcp.14189.
12. Ascha M, Bhattacharyya A, Ramos JA, et al. Pulse Oximetry and Arterial Oxygen Saturation during Cardiopulmonary Exercise Testing. *Med Sci Sports Exerc*. Epub ahead of print 2018. DOI: 10.1249/MSS.0000000000001658.
13. Benck LR, Cuttica MJ, Colangelo LA, et al. Association between cardiorespiratory fitness and lung health from young adulthood to middle ages. *Am J Respir Crit Care Med*. Epub ahead of print 2017. DOI: 10.1164/rccm.201610-2089OC.
14. Bajramovic I, Redzepagic S, Bjelica D, et al. Level of Active Lifestyle and Exercise Approach among Sports-Active Female Students of The University of Sarajevo during the Covid-19 Pandemic. *J Anthr Sport Phys Educ*.
15. Kenney WL, Wilmore JH, Costil DL. *Physiology of Sport and Exercise*. Sixth Edition. 2015.
16. Smith TC, Wingard DL, Smith B, et al. Walking decreased risk of cardiovascular disease mortality in older adults with diabetes. *J Clin Epidemiol*. Epub ahead of print 2007. DOI: 10.1016/j.jclinepi.2006.06.013.
17. Piercy KL, Troiano RP, Ballard RM, et al. The physical activity guidelines for Americans. *JAMA*, <https://jamanetwork.com/journals/jama/article-abstract/2712935> (2018).
18. Maurya PK, Kumar P, Chandra P. Biomarkers of oxidative stress in erythrocytes as a function of human age. *World J Methodol*. Epub ahead of print 2015. DOI: 10.5662/wjm.v5.i4.216.
19. Taylor CM, Northstone K, Wernimont SM, et al. Macro-and micronutrient intakes in picky eaters: A cause for concern? 1-3. *American Journal of Clinical Nutrition*. Epub ahead of print 2016. DOI: 10.3945/ajcn.116.137356.
20. Crispin P. Effect of anemia on muscle oxygen saturation during submaximal exercise. *Transfusion (Paris)*. Epub ahead of print 2020. DOI: 10.1111/trf.15588.
21. Porcari JP, Bryant CX, Comana F. *Exercise Physiology (Foundations of Exercise Science)* 1st Edition. 2015.
22. Sharon A. Plowman DLS. *Exercise Physiology for Health, Fitness, and Performance*. 2017.
23. Seco J, Abecia LC, Echevarría E, et al. A long-term physical activity training program increases strength and flexibility, and improves balance in older adults. *Rehabilitation Nursing*. Epub ahead of print 2013. DOI: 10.1002/rnj.64.