Determinants of and barriers to physical activity for women in Jeddah, Saudi Arabia

Salhah Alsulami

Assistant Professor at Rabigh Faculty of Medicine and Internal Medicine/Women's Health Consultant, King Abdulaziz University, Jeddah, Saudi Arabia

Correspondence:
Salhah Alsulami
Assistant Professor at Rabigh Faculty of Medicine and Internal Medicine/Women's Health Consultant, King Abdulaziz University, Jeddah, Saudi Arabia
Email: salhasolami@hotmail.com

Received: November 2022 Accepted: December 2022; Published: December 15, 2022.
Citation: Salhah Alsulami . Determinants of and barriers to physical activity for women in Jeddah, Saudi Arabia. World Family Medicine. December 2022 - January 2023; 21(1): 101-109 DOI:10.5742/MEWFM.2023.95251507

Abstract

Background: Physical activity (PA) has been linked to a variety of health benefits, disease prevention, and treatment. Understanding cultural influences are important for the effective promotion of PA. This study examined PA among women in Jeddah, Saudi Arabia, and the determinants and barriers to it.

The research was conducted through a cross-sectional survey. The Arab Teens Lifestyle (ATLS) questionnaire was completed by 1238 randomly selected women in Jeddah. It includes the repetitions and average duration of different types of physical activities per typical week. In addition, the participants self-reported their anthropometric measurements.

Results: 76.4% met the minimum requirement for moderately vigorous physical activity (MVPA), but only 19.5% met both MVPA and muscle-strengthening activity (MSA). The two main barriers to participation in PA are the lack of sports facilities and time constraints. The number of comorbidities, calculated body mass index (BMI), and waist circumference were significant determinants of PA (R2 =.27)

Conclusion: Women largely ignore MSA despite engaging in a high percentage of MVPA. The presence of comorbidities and obesity are the most important determinants of PA. Finally, these data can be used to develop early interventions to promote health instead of managing complications.

Keywords: Physical Activity, Obesity, Barriers, Determinants, Women, Sports, Saudi Arabia.

Introduction

Physical activity (PA) is defined as “any movement that requires energy expenditure”. Physical inactivity is a major public health concern around the world (1). Moreover, physical inactivity accounts for 0.3-4.6% of national healthcare spending (1). Inactive people have a 20-30% higher death rate (2). The WHO recommends 150-300 minutes of moderate activity per week or 75-150 minutes of vigorous activity per week for adults between 18 and 64. Further, two or more days of muscle-strengthening exercise per week are recommended for additional health benefits. Sedentary activity should also be limited. These recommendations apply to pregnant and post-partum women who have no obstetric contraindications.

Obesity and being overweight, diabetes mellitus, cardiovascular disease, mental disorders, osteoporosis, and cancer have all been linked to physical inactivity. (1,3,4). Regular physical activity has been shown to have significant benefits in reducing these complications (5). With relatively minor physical activity, significant health benefits can be obtained.6 MSA has a significant effect on improving muscular strength in healthy adult females. Training duration and repetition appear to be important determinants of muscular strength (7). In older women resistance training for a period of 8 weeks lowers inflammatory markers including high sensitivity CRP, IL6, TNFα, and TNFα gene expression and results in a change in body composition (8).

Physical inactivity is the most common noncommunicable disease risk factor among Saudis (9). It affects up to 85% of males and 91% of females (10). Physical inactivity affects 68% of females living in the western region of Saudi Arabia (11). The most common barriers to physical activity in middle-aged and older adults were identified as environmental factors and resources (12). Young females from the Middle East and North African countries engaged less in PA and reported significant barriers compared to young males (13).

Physical activity is the first step in preventing many diseases and promoting health and well-being. Despite the fact that there is a wealth of literature on PA behaviours in Saudi Arabia and other countries, (10,14) there is a lack of research on the prevalence of physical inactivity and the attitudes of women toward PA following a dramatic shift in physical activity and health promotion efforts by the Saudi government and health agencies. The purpose of this study is to assess physical activity among a spectrum of females from different age groups. In addition, to identify barriers, and determinants of physical activity five years after these regulations were implemented.

Materials and Methods

Study context and settings:
A cross-sectional study was conducted. A sample size of 378 was calculated, assuming a prevalence of physical inactivity of 43.3%, absolute precision of 5%, and a non-response rate of 10%.15 Women over the age of 18 who consented to participate in the study, residing in Jeddah City between November 2021 and September 2022, were included in the study. There were a variety of public places where participants could be approached, including parks, malls, and universities. They were asked to fill out a self-administered questionnaire. All participants provided written consent and were informed that their participation was entirely voluntary.

Data collection:
Basic demographic information, self-reported anthropometric measurements, information about obesity-related complications as per physician diagnosis, and their latest blood pressure reading were all requested in the questionnaire. Explanatory images were included to clarify waist circumference measurement and approximate pant size requested in the event that they did not remember their waist circumference. Following that, participants were asked to provide detailed physical activity types, average duration, and repetitions for a typical week. Additionally, the average time spent on TV/internet was examined. Responses ranges from (I don’t use, 1-3 hours, >3-5 hours, > 5hours/day). Participants were asked about their motivation, barriers to physical activity, and preferences. With permission from the corresponding author, the questionnaire was adapted from the Arabic, validated Arab Teens Lifestyle (ATLS) questionnaire(16).

Data collection tool:
Walking, moderate-intensity sports (volleyball, table tennis, and bowling), swimming, household activities (gardening, car washing, and vacuuming) and dancing were all considered moderate-intensity activity and multiplied by four. High-intensity sports (soccer, tennis, handball, and basketball), self-defense exercises (kick boxing, judo, karate, taekwondo) and running, on the other hand, were considered high-intensity activities and multiplied by 8.17 The METs were then multiplied by the average duration of physical activity multiplied by the number of repetitions per week and expressed in METs-min/week.

Data analysis:
All data entered was compiled using the Statistical Package for Social Sciences (SPSS) version 20. For categorical and continuous variables, frequency, percentages, means, and standard deviations (SD) were used. Based on their total activity energy expenditure in METs-min/week, participants were divided into two groups. Physically inactive who had less than 600 METs-min/week (equal to 150 min/week of moderate physical activity), and physically active who had 600 METs-min/week or more. To compare the frequency and proportion of the two groups, cross-tabulation with Chi-Square tests was also used. Furthermore, linear regression analysis with the

enter method was used to predict the total time spent in PA. The following variables were entered in the regression analyses: age, BMI, waist circumference, systolic, diastolic blood pressure, and the number of comorbidities. Women were classified as non-active (PA < 600 MET/week), low level MVPA (PA > 600 but < 1,500 MET/week), moderate level MVPA (PA > 1,500 but < 3,000 MET/week), and high level MVPA (PA > 3,000 MET/week) in this questionnaire. The predictors of engaging in different levels of physical activities including high, moderate, and low levels were identified in comparison to the physically inactive group using multinomial logistic regression analysis. The level of statistical significance was set at $P < 0.05$.

Before beginning the study, the bioethical committee gave its approval.

Results

The characteristics of the study sample

The characteristics of the study sample are shown in Table 1. A total of 1238 women were included in the study (mean age=34.4± 13; mean BMI=26± 6.5). The vast majority (85.7%) of the sample were Saudi nationals. 54.5 % were married, 38.6 % were single, and the remainder were divorced or widowed. 63.3% had a bachelor's degree, while 29.5% had a secondary school education or below. The majority of participants (93.4%) were non-smokers. 23.5% and 28.1% were obese and overweight respectively and 67.1% achieved a minimum of 150 min/week (600 METs-min /week) of moderately vigorous physical activity (MVPA). Furthermore, active participants were divided into three categories: low level MVPA (37.9%) (600-1499 METs-min/week), moderate level MVPA (19.4%) (1500-2999 METs-min/week), and high level MVPA (9.9%) (>3000 METs-min/week). 21.9% of participants engaged in 2 or more days of MSA. While 19.5% meet both requirements of low level of MVPA and MSA.

Table 2 displays the barriers and preferences of participants toward physical activity. The most common barriers to exercise were a lack of time (38.4%) and a suitable facility (14.8%). More than half of the participants exercised alone, while (14%) exercised with friends. Around 30 % of respondents did not prefer a specific time to engage in physical activity, with night-time being preferred by 26% of women surveyed. 42.7% of participants practiced exercise at home, with 19.1%) doing so in public places. Walking is the most popular form of physical activity among women, followed by jogging and muscle strengthening exercises.

Comparison between physically inactive and active groups

Table 3 contrasted groups that were physically active and inactive. In terms of socioeconomic factors, older people are more physically active than younger people. Single females are less physically active than married, divorced, or widowed women. Furthermore, higher educational attainment is common in physically active participants. In addition, public sector workers have the highest percentage of physical activity (76%) while students have the lowest (57.4%). Additionally, (89.6%) of the respondents with more than two obesity-related comorbidities are physically active, compared to (59 %) of those who are disease-free. The level of physical activity did not differ between smokers and non-smokers. Physical activity is practiced by (78.8%) of obese participants and (68.1%) of participants with normal body weight.

Multinomial logistic regression classifying physical activity into non, low, moderate, and highly physically active

Model of multinomial logistic regression Table 4 shows that an increase in BMI is a significant predictor of engaging in a high and moderate level of MVPA, with (OR=1.2;95%CI: 1.06-1.39) and (OR=1.14;95%CI:1.03-1.26) respectively. Only the number of comorbidities was a significant predictor of high physical activity (OR= 2.79;95%CI: 1.56-4.97). Increased use of TV/computer, on the other hand, is a significant predictor of low physical activity (OR= 1.31; 95%CI:1.03-1.66).

Linear regression analysis, with outcome variable physical activity METs-min/week

Linear regression for predictors of total time spent in PA per week is displayed in Table 5. In descending order, the number of comorbidities, calculated BMI, and waist circumference were significant determinants for PA with (R= .524, R2=.274). This means that these determinants can explain 27% of the variance in the total time particicipants spent in PA.

Table 1: Characteristics of study sample(n=1238)

Variables	Mean (SD)
Age (years)	34.43 (12.976)
Weight(kg)	64.71 (15.817)
BMI	25.96 (6.477)
Physical activity (METs- min/week)	1339 (1352)
Time spent for physical activity (min/week)	264.90 (230.31)
Variables	**Frequency (%)**
Nationality:	
Saudi	1061 (85.7%)
Non-Saudi	177 (14.3%)
Social status:	
Married	675 (54.5%)
Single	478 (38.6%)
Widowed	25 (2.0%)
Divorced	60 (4.8%)
Educational level:	
Illiterate	15 (1.2%)
Secondary or below	365 (29.5%)
Bachelor's degree	784 (63.3%)
Post-graduate	74 (6.0%)
Smoking status:	
Smoker	82 (6.6%)
Non-smoker	1156 (93.4%)
Physical activity level:	
Physically inactive MVPA<600 METs-min/week	403 (32.6%)
Low level MVPA 600 -1499 METs-min/week	469 (37.9%)
Moderate level MVPA 1500-2999 METs-min/week	240 (19.4%)
High level MVPA 3000 or more METs-min /week	122 (9.9%)
Muscle strengthening MSA 2 or more days/week	270 (21.9%)
Meet both low level of MVPA and MSA	241 (19.5%)
BMI categories:	
Underweight(BMI<18.5)	108 (8.7%)
Normal weight(BMI 18.5-24.9)	457 (36.9%)
Overweight(BMI 25-29.9)	348 (28.1%)
Obese(BMI ≥30)	291 (23.5%)

Table 2: Barriers, and preferences of physical activity

Variables	Frequency (%)
Barriers to exercise*:	
Time limitation	476 (38.4%)
Other reasons	167 (13.4%)
Lack of suitable facility	183 (14.8%)
Afraid of criticism	36 (2.9%)
I think it is not important	31 (2.5%)
Have medical condition that limits PA	60 (4.8%)
Preferred exercise partner:	
Alone	671 (54.2%)
Friends	183 (14.8%)
Family members	154 (12.4%)
Work peers	15 (1.2%)
Other exercise partner	34 (2.7%)
Preferred time to exercise:	
No specific time	382 (30.9%)
Night	328 (26.5%)
Morning	169 (13.7%)
Evening	167 (13.5%)
Preferred place of exercise:	
Home	529 (42.7%)
Public spaces	236 (19.1%)
School	29 (2.3%)
Gym	145 (11.7%)
Others	78 (6.3%)
Preferred type of physical activity:	
Walking	467 (37.8%)
Jogging	189 (15.3%)
Muscle strengthening	125 (11%)
Moderate intensity exercise	87 (7%)
High intensity exercise	68 (5.5%)

*A list of common barriers was provided to participants who admitted to not doing any PA (they could select more than one barrier)

Table 3. Comparison between physically inactive and active groups

Variables	Physically inactive n=403(32.7%) N (%)	Physically active n=831(67.1%) N (%)	P value
Age			
≤ 40 years	302 (37.7%)	500 (62.3%)	< .01
> 40 years	101 (23.4%)	331 (76.6%)	
Social status			
Single	186 (39.0%)	291 (61.0%)	< .01
Married	192 (28.6%)	480 (71.4%)	
Widowed	7(28%)	18 (72%)	
Divorced	18 (30%)	42 (70%)	
Occupation			
Health care worker	21 (29.6%)	50 (70.4%)	< .01
Student	152 (42.6%)	205 (57.4%)	
Housewife	99 (28%)	255 (72%)	
Public sector worker	59 (23.6%)	191 (76.4%)	
Private sector worker	31 (36%)	55 (74%)	
Educational level			
Illiterate	11 (73.3%)	4 (26.7%)	< .01
Secondary or below	115 (31.6%)	249 (68.4%)	
Bachelor's degree	260 (33.3%)	521 (66.7%)	
Post graduate studies	17 (23%)	57 (77%)	
BMI categories			
Underweight (18.5kg/m^2)	69 (53.6%)	52 (46.4%)	
Normal (18.5and24.9kg/m^2)	174 (38.2%)	281 (61.8%)	< .01
Overweight (25 and29.9kg/m^2)	100 (28.9%)	246 (71.1%)	
Obese (≥30 kg/m^2)	62 (21.2%)	230 (78.8%)	
Presence of obesity related comorbidities			
None	345 (41.0%)	497 (59.0%)	
1-2 comorbidities	51 (15.0%)	289 (85.0%)	< .01
More than 2 comorbidities	5 (10.4%)	43(89.6%)	
Smoking			
Smoker	22 (27.2%)	59 (72.8%)	.33
Non-smoker	381 (33%)	772 (67%)	

Activity classification based on above or below 150 min/week of total physical activity. To compare the two groups, the Chi-square test was used.

Table 4. Multinomial logistic regression classifying physical activity into non, low, moderate, and highly physically active

Variable	High level MVPA (>3000METs-min/week)		Moderate level MVPA (1500-2999METs-min/week)		Low level MVPA (600-1499METs-min/week)	
	OR (95%CI)	P value	OR (95%CI)	P value	OR (95%CI)	P value
Calculated BMI	1.21 (1.06-1.39)	**.01**	1.138 (1.03-1.26)	**.01**	1.04 (.94-1.16)	.43
Waist circumference	1.04 (.99-1.08)	.08	1 (.97-1.03)	.99	.990 (.96-1.02)	.47
Number of comorbidities	2.79 (1.56-4.97)	**.00**	1.33 (.81-2.18)	.25	.753 (.46-1.25)	.27
Average time of watching TV/computer	.94 (.72-1.22)	.65	1.14 (.91-1.41)	.25	1.31 (1.03-1.66)	**.03**

Reference category: physically non-active

Table 5. Linear regression analysis, with outcome variable physical activity METs-min/week

Variables	Unstandardized coefficients		Standardized coefficients Beta	95% CI for B		P value
	B	Std. error		Upper bound	Lower bound	
Age	-8.86	7.92	-.08	-24.46	6.74	.26
Waist circumference	16.26	6.07	.18	4.31	28.22	< **.01**
Calculated BMI	75.53	20.07	.26	35.98	115.08	< **.01**
Number of comorbidities	534.94	94.79	.37	348.1	721.78	< **.01**
Systolic blood pressure	-12.4	7.99	-.1	-28.15	3.36	.12
Diastolic blood pressure	-2.90	10.78	-.02	-24.15	18.35	.79

Dependant variable: Total physical activity METs-min/week

Discussion

The current poll included 1238 women with a mean age of 34 years. Physically active people are older, have obesity and have obesity related comorbidities. Increasing BMI and the number of comorbidities is significant independent predictors of engaging in high physical activity. Almost one-third did not meet the minimum physical activity requirement, with only 10% achieving the cut-off of 3000 METs-min/week. Over the last 20 years, Saudi Arabia has had a high prevalence (43-91%) of physical inactivity among all adults, more markedly in women (18,19). According to a recent national survey, 51% of women met the recommended level of moderate to vigorous physical activity (20). This is consistent with a Jazan study that found 59% of females classified as physically active (21). Many factors contribute to our study participants' high level of physical activity when compared to other local studies. Initially, the PA assessing tool used by research (ATLS) included household chores, which are primarily performed by women. Secondly, there is increased awareness of the benefits of physical activity, as well as the availability of public spaces and fitness centres in Jeddah. This disparity can also be explained by the season, as the current survey was conducted in the fall and winter seasons when the weather in Jeddah is pleasant.

Students and people of a younger age are less physically active than other groups of women. These findings are consistent with previous research that found a higher percentage of physical inactivity among female college students and office workers (46-61 percent).(22–24). Recent research indicates that physical activity fluctuates throughout life and decreases during some transitions. Subgroup support is therefore necessary in order to increase physical activity and decrease sedentary behaviours. Transitioning from childhood to adulthood is one of these transitions, where heavy workload is predominant and time constraints were the most common obstacle to PA.(25).

Walking is the most popular type of physical activity among participants, followed by jogging, and less frequently muscle strengthening. 21.9% of women practice two or more days per week of MSA and 20% only achieved both low-level MVPA and 2 or more days of MSA. Although the MSA in our study was higher than the reported national survey (19) which was less than 1%, it was far from

sufficient among study participants despite growing evidence of unique benefits for women (7,8). Physical inactivity among Saudi women can be attributed to a lack of understanding of the health benefits of PA (27).

Obesity and the presence of physical inactivity-related comorbidities are independent determinants of engaging in physical activity which is consistent with the local study (23). One explanation for these findings could be that many overweight/obese females are frequently involved in weight loss programmes involving physical activity and low-calorie diets.

In summary, the current study recruited a large number of women of various ages, socioeconomic backgrounds, and educational levels. A strength of the study is the use of valid, widely used tools that included both MVPA and MSA. Due to the random selection of participants the sample may not be representative. In addition, enrolling women in public spaces may inflate the results as a significant proportion of participants used to practice PA there. Secondly, responses were based on self-reported anthropometric measurements. A cohort study discovered that both genders tend to underreport their weight and overreport their height, causing BMI to be underestimated (28). The results of the study may not be generalizable as Saudi Arabia is a large country with varying weather, norms, and facilities and the findings may not be applicable to the entire population. More research is required to determine the influence of personal and virtual training on physical activity preference. Larger studies are needed to assess the impact of technology-assisted motivators, specifically the cross-country walking campaign Walk 30, which was launched by the Saudi Ministry of Health (MOH) in 2020 with the goal of achieving 8000 steps per day (29). It is a step counter feature of "Sehhaty," a Saudi Ministry of Health official smartphone application. More research on subgroups such as pregnant and postpartum women is required as well as postpartum women.

Conclusion

This research shed some light on the determinants and barriers to physical activity in a large group of women. The goal of this study was to identify key drivers of PA rather than to critically evaluate motivations and barriers. Obesity and the presence of comorbidities are the main determinants of engagement in PA. The findings of this study can be used to enhance awareness of physical activity in general, and MSA in particular for all women, as well as promote a reduction in sedentary behaviours. The benefits of an active lifestyle for all should be encouraged and should begin very early in life and across all weight categories. It should be recommended to all women, not just those who are sick or obese. Providing resources and activities for women that consider time, energy, and schedule constraints would be appropriate considerations as monitoring PA barriers is critical to the success of health-promoting initiatives.

References

1. World Health Organization. physical activity . https://www.who.int/news-room/fact-sheets/detail/physical-activity.
2. Ding D, Kolbe-Alexander T, Nguyen B, Katzmarzyk PT, Pratt M, Lawson KD. The economic burden of physical inactivity: a systematic review and critical appraisal. Br J Sports Med. 2017;51(19):1392-1409. doi:10.1136/bjsports-2016-097385
3. Melissa I Carter, Pamela S Hinton. Physical activity and bone health. Mo Med. 2014;111(1):59-64.
4. Clinton SK, Giovannucci EL, Hursting SD. The World Cancer Research Fund/American Institute for Cancer Research Third Expert Report on Diet, Nutrition, Physical Activity, and Cancer: Impact and Future Directions. J Nutr. 2020;150(4):663-671. doi:10.1093/jn/nxz268
5. World Health Organization. Global recommendations on physical activity for health. Geneva, Switzerland: World Health Organization.
6. Warburton DER, Bredin SSD. Health benefits of physical activity. Curr Opin Cardiol. 2017;32(5):541-556. doi:10.1097/HCO.0000000000000437
7. Hagstrom AD, Marshall PW, Halaki M, Hackett DA. The Effect of Resistance Training in Women on Dynamic Strength and Muscular Hypertrophy: A Systematic Review with Meta-analysis. Sports Medicine. 2020;50(6):1075-1093. doi:10.1007/s40279-019-01247-x
8. Macêdo Santiago LÂ, Neto LGL, Borges Pereira G, et al. Effects of Resistance Training on Immunoinflammatory Response, TNF-Alpha Gene Expression, and Body Composition in Elderly Women. J Aging Res. 2018;2018:1-10. doi:10.1155/2018/1467025
9. Al-Hanawi MK, Keetile M. Socio-Economic and Demographic Correlates of Non-communicable Disease Risk Factors Among Adults in Saudi Arabia. Front Med (Lausanne). 2021;8. doi:10.3389/fmed.2021.605912
10. Hazzaa M. Al-Hazzaa. Physical inactivity in Saudi Arabia revisited: A systematic review of inactivity prevalence and perceived barriers to active living. Int J Health Sci (Qassim). 2018;12(6):50-64.
11. Al-Zalabani AH, Al-Hamdan NA, Saeed AA. The prevalence of physical activity and its socioeconomic correlates in Kingdom of Saudi Arabia: A cross-sectional population-based national survey. J Taibah Univ Med Sci. 2015;10(2):208-215. doi:10.1016/j.jtumed.2014.11.001
12. Spiteri K, Broom D, Hassan Bekhet A, Xerri de Caro J, Laventure B, Grafton K. Barriers and Motivators of Physical Activity Participation in Middle-Aged and Older Adults—A Systematic Review. J Aging Phys Act. 2019;27(6):929-944. doi:10.1123/japa.2018-0343
13. Chaabane S, Chaabna K, Doraiswamy S, Mamtani R, Cheema S. Barriers and Facilitators Associated with Physical Activity in the Middle East and North Africa Region: A Systematic Overview. Int J Environ Res Public Health. 2021;18(4):1647. doi:10.3390/ijerph18041647
14. Al-Hazzaa HM, Abahussain NA, Al-Sobayel HI, Qahwaji DM, Musaiger AO. Lifestyle factors associated with overweight and obesity among Saudi adolescents. BMC Public Health. 2012;12(1):354. doi:10.1186/1471-2458-12-354

15. H M Al-Hazzaa. Prevalence of physical inactivity in Saudi Arabia: a brief review. Eastern Mediterranean Health Journal. 2004;10:663-670.
16. Al-Hazzaa HM, Al-Sobayel HI, Musaiger AO. Convergent Validity of the Arab Teens Lifestyle Study (ATLS) Physical Activity Questionnaire. Int J Environ Res Public Health. 2011;8(9):3810-3820. doi:10.3390/ijerph8093810
17. AINSWORTH BE, HASKELL WL, HERRMANN SD, et al. 2011 Compendium of Physical Activities. Med Sci Sports Exerc. 2011;43(8):1575-1581. doi:10.1249/MSS.0b013e31821ece12
18. Mansour M Al-Nozha, Hazzaa M Al-Hazzaa, Mohammed R Arafah, et al. Prevalence of physical activity and inactivity among Saudis aged 30-70 years. A population-based cross-sectional study. Saudi Med J. 2007;28(4):559-568.
19. Alqahtani BA, Alenazi AM, Alhowimel AS, Elnaggar RK. The descriptive pattern of physical activity in Saudi Arabia: analysis of national survey data. Int Health. 2021;13(3):232-239. doi:10.1093/inthealth/ihaa027
20. Althumiri NA, Basyouni MH, AlMousa N, et al. Obesity in Saudi Arabia in 2020: Prevalence, Distribution, and Its Current Association with Various Health Conditions. Healthcare. 2021;9(3):311. doi:10.3390/healthcare9030311
21. Wafi A, Aqeel A, Zogel B, et al. Adherence to Physical Activity Recommendations in the Adult Population of Jazan Region. Cureus. Published online March 25, 2022. doi:10.7759/cureus.23481
22. Azhar A, Aldaheri RE, Alqurashi YF, Alalyani WM, Albandar AA. Impact of physical activities on quality of life among female medical students in King Abdulaziz University. Med Sci. 2022;26(119):1. doi:10.54905/disssi/v26i119/ms39e2063
23. Albawardi NM, Jradi H, Al-Hazzaa HM. Levels and correlates of physical activity, inactivity and body mass index among Saudi women working in office jobs in Riyadh city. BMC Womens Health. 2016;16(1):33. doi:10.1186/s12905-016-0312-8
24. Alhakbany MA, Alzamil HA, Alabdullatif WA, Aldekhyyel SN, Alsuhaibani MN, Al-Hazzaa HM. Lifestyle Habits in Relation to Overweight and Obesity among Saudi Women Attending Health Science Colleges. J Epidemiol Glob Health. 2018;8(1-2):13. doi:10.2991/j.jegh.2018.09.100
25. Lane-Cordova AD, Jerome GJ, Paluch AE, et al. Supporting Physical Activity in Patients and Populations During Life Events and Transitions: A Scientific Statement From the American Heart Association. Circulation. 2022;145(4). doi:10.1161/CIR.0000000000001035
26. Amin TT, al Khoudair AS, al Harbi MA, al Ali AR. Leisure Time Physical Activity in Saudi Arabia: Prevalence, Pattern and Determining Factors. Asian Pacific Journal of Cancer Prevention. 2012;13(1):351-360. doi:10.7314/APJCP.2012.13.1.351
27. Alandijani AA, Alali SY, Alotaibi AS. Study of Knowledge, Attitude and Practice of Saudi Women towards Physical Activity, 2017. Egypt J Hosp Med. 2017;69(2):1964-1967. doi:10.12816/0040630
28. Hodge JM, Shah R, McCullough ML, Gapstur SM, Patel A v. Validation of self-reported height and weight in a large, nationwide cohort of U.S. adults. PLoS One. 2020;15(4):e0231229. doi:10.1371/journal.pone.0231229
29. Walk challenge. Available online:https://www.moh.gov.sa/awarenessplateform/HealthyLifestyle/Pages/WalkingCompetition.aspx. last accessed:30-10-2022.