Original Article

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Physical activity, sedentary time and motivation to change: an Italian survey

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Abstract: Given the high levels of inactivity and sedentary lifestyle in the general population and the barriers (including motivational ones) to the practice of regular physical activity, our study aims to evaluate the physical activity levels (PAL), sitting time (SIT), and motivation to change (MTC) lifestyle in a group of volunteer adults participating in an online survey promoted in some Italian regions. From December 2022 to March 2023, 127 adults (65 men and 62 women, mean age=40.17±14.83 years), volunteers, were involved in this study. Participants were invited to complete one-time online survey. General information, anthropometric, and questionnaire measures were collected. According to inclusion criteria, four participants were excluded; here we present results for 123 subjects. Data were studied for active/inactive and gender subgroups. Finally, the PAL and SIT categories were linked to motivational data. 54.8% of the participants did not report particular pathologies. 52.8% of participants replied that they regularly exercised. 44.4% engaged in physical activity alone, while 27% did so with friends, and 23.8% with a kinesiologist. Differences were observed both in the energy expenditure due to vigorous PA and in total energy expenditure. Regarding SIT, there were no differences between genders during weekdays. All the sample presented a high percentage in contemplation status but had medium scores in preparation and maintenance status. A statistically significant difference was observed in the contemplation state: we found higher average values regarding self-efficacy and readiness to change in men. It is necessary to plan campaigns to raise awareness and monitor the population's lifestyles beginning in the first decades of adulthood, promoting healthy lifestyle education initiatives to control the risk of non-communicable diseases.

Keywords: physical activity; sitting time; ipaq; motivation to change

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INTRODUCTION

In recent decades, scientific literature has given ample prominence to the beneficial effects of physical activity (PA) and its effect on social, health, economic, and cultural levels. Many studies [1] have demonstrated the scientific value of prevention through PA. However, despite the scientific evidence, levels of PA are low in many populations globally, and this has been recognized as a major public health problem [2,3]. Low levels of PA are associated with increased chronic non-communicable diseases (NCDs), reduced health-related quality of life, and diminished mental health [4-7]. Particularly, Zhang and coauthors [8] recently proposed the expression "adult inactivity triad", including exercise deficit disorder (a condition characterized by PA levels lower than recommended [9]), sarcopenia, and physical illiteracy (defined as a lack of confidence, ability, and motivation to engage in significant physical activity with commitment and desire [9]).

Simultaneously, over the years, technology has reduced human caloric expenditure during daily activities and in work settings [10]. Sedentariness, defined as “any waking behavior characterized by an energy expenditure ≤1.5 METs”, [11] increased in the world population, representing a high risk to people’s health [12,13]. In fact, sedentariness, especially sitting time (SIT) is associated with an increased incidence of chronic diseases such as type 2 diabetes, cardiovascular disease, cancers, and premature mortality [14,15]. These NCDs could be the new pandemic that will hit the world's population 30 years from now [16-19]. According to the "WHO European Regional Obesity Report 2022" [20] a sedentary lifestyle leads to real pandemic numbers and, since 59% of European adults are overweight, the WHO Report estimated that this could lead to 1.2 million deaths per year, corresponding to about 13% of total deaths in Europe.

This situation has led major health prevention authorities (WHO, the European Community, and Ministries of Health) to shape a series of initiatives and summits to enhance the promotion of PA and to develop effective policies to prevent avoidable deaths from sedentary and unhealthy lifestyles [1, 19, 21]. Understanding PA behaviors and the factors, including environmental ones [22, 23], that contribute to PA levels is the key to achieving effective promotion of PA. Moreover, several studies have confirmed the importance of understanding the elements of motivation to change (MTC) [24-27] and motivational interviews to improve a person's lifestyle [28].

Previous authors reviewed the contribution of social-cognitive theories [29, 30,] to explore the motivations underlying humans’ insufficient PA. For example, Prochaska and Di Clemente [31] theorized behavior as a process and determined that there are five stages through which behavioral change occurs over time. In particular, Schroè and coauthors [30] report that different combinations of behavior change techniques (BCTs) may be effective in promoting PA and reducing sedentary behaviors. The use of BCTs in combination with delivery/context components, individually and synergistically, promotes the effectiveness of physical activity interventions [26] while mobile health (mHealth) intervention based on the self-regulatory theory appears useful as an additional tool with older adults [32].

This study aims to evaluate the PA levels (PAL), SIT, and MTC lifestyle in a group of volunteer adults participating in an online survey promoted throughout eleven Italian regions. We hypothesized that physically active individuals would show different levels of PAL, SIT, and MTC parameters compared to their inactive counterparts.

MATERIAL AND METHODS

Participants

From December 2022 to March 2023, 127 adults (65 men and 62 women, mean age=40.17±14.83 years), volunteers, were involved in this study, using convenience/availability, sampling. According to inclusion criteria, four participants were

excluded by the analysis that involved 123 subjects (geographical origin: Umbria, n=45, 36.6%; Calabria, n=50, 40.7%; Lombardy, n=4, 3.3%; Tuscany, n=15, 12.2%; 5: Marche, n=2, 1.6%; Sicily, n=2, 1.6%; Puglia, n=1,0.8%; Lazio, n=1,0.8%; Sardinia, n=1,0.8%; Piedmont, n=1,0.8%; and Basilicata, n=1,0.8%). The initiative was promoted in some Italian regions through universities' institutional websites and social channels. Participants were invited to complete a one-time online survey via a Google Forms sheet. The original version of the survey was available at link https://forms.gle /TRrWzpgtvEWodyFP6.

Preliminarily, participants signed an online informed consent to be included in the study and for the anonymous processing of personal data, according to the General Regulation on the Protection of Personal Data (EU Regulation 2016/679 of the European Parliament and of the Council of 27 April 2016, GDPR). Then, participants were invited to fill out a questionnaire including items from validated instruments. The study's inclusion criteria were: age ≥18 years; Body Mass Index (BMI) ≥18.5; willingness to answer the questions in a computer-based survey. The exclusion criteria were: the presence of conditions that contraindicate PA; fictitious answers; and failure to provide written informed consent. The study was conducted in compliance with the ethical principles of the Declaration of Helsinki.

Protocol

All the respondents' group was studied for measures reported in the next section "measures". Later, data were analysed based on gender (men and women groups) and based on replies to the question "Do you practice physical activity regularly? Those who replied "yes" were allocated to the active group while those who said "no" were placed in the inactive group. Then, according to their PAL, the respondents were allocated into three subgroups, according to IPAQ scoring guidelines [33]: group 1, "low PAL", (n = 27, mean = 6.6 ± 5.6 MET-h per week); group 2, "moderate PAL", (n = 61, mean = 30.7 ± 11.8 MET-h per week); and group 3, "high PAL", (n = 35, mean = 99.4 ± 45.6 MET-h per week). Moreover, in accordance with Ekelund and coauthors [34], participants were allocated into four subgroups, based on their levels of SIT: group 1, "low SIT", corresponding to <4 h/day (n = 51, mean = 2.1 ± 1.0 h/day); group 2, "medium SIT", corresponding to 4–5.9 h/day (n = 22, mean = 4.6 ± 0.6 h/day); group c, "high SIT", corresponding to 6–8 h/day of sitting time (n = 33, mean = 7.0 ± 0.9 h/day); and group 3, "very high SIT", corresponding to >8 h/day of sitting time (n = 5, mean = 10.5 ± 1.3 h/day). According to the WHO criteria [35], BMI values were used to define participants as people of normal weight, corresponding to BMI 18.5-24.9 (group 1, n = 72, BMI mean = 22.38±1.65), people who were overweight, corresponding to BMI 25–29.9 (group 2, n = 46, BMI mean = 27±1.23), and people who were obese, corresponding to BMI 30–34.9 (group 3, n = 5, BMI mean = 33.06±1.43). Finally, PAL and SIT categories were linked to motivational data.

Measures

1) Anthropometric measures, such as height and body weight were reported by participants in specific items of the online questionnaire. The BMI value was then calculated as weight (kg) divided by square height (m^2).

2) Self-Reporting Questionnaires Measures. Some items were used to collect information concerning:

a) *General information*. In the first part of the questionnaire, some socio-demographics were collected, such as region, province, city of residence, working status, age, sex, and marital status. Participants were also asked to provide information regarding income status (monthly), health conditions, and annual expenses for health and health services (i.e., drugs, analyses, specialist medical visits, physiotherapy). Finally, the questionnaire asked, "Do you practice physical activity regularly?", which directed the responder in two different ways. If the participants answered YES, they were allocated to the ACTIVE subgroup and the following additional questions were asked: "With

whom do you practice physical activity, exercise, or sport?", "Mainly where do you practice sport?" and "What do you think is the purpose of practicing physical activity every day?". On the other hand, when participants answered NO, they were allocated to the INACTIVE subgroup. In this case, the following questions were provided: "If you were facilitated in starting X physical activity, in an adequate structure, followed by specialized personnel, would you do it?" and "What are the reasons why you do not exercise regularly?". Some items in this section were selected from "il costo sociale e sanitario della sedentarietà", a report by the Association of UISP (Unione Nazionale Sport Per tutti), Svimez (Associazione per lo Sviluppo dell'Industria nel Mezzogiorno) and Sport E Salute [36].

b) *PA levels (PAL) and sitting time activity (SIT)* were studied through the IPAQ-short form questionnaire [37], a validated tool that assesses activity conducted in the previous seven days. IPAQ allowed us to identify the number of days a respondent engaged in vigorous-intensity, moderate-intensity physical activity and walking, and how long they engaged in activity on each of the days that they indicated (i.e., total weekly time in walking activity, or TOTWALK, was calculated as the number of day x time; for example, if the respondent reported walking for 20 minutes 5 days a week then the TOTWALK amount was 20 x 5=100 minutes/week). According to the IPAQ scoring manual [33], PA data were expressed in METs. Various types of movement intensity were recorded assigning the following coefficients to each category (3.3 METs for walking, 4 METs for moderate-intensity activity, and 8 METs for vigorous-intensity activity). Consequently, walking energy expenditure (EEWALK) resulted from walking minutes x walking days x 3.3, while moderate-intensity activity energy expenditure (EEMOD) resulted from moderate-intensity activity minutes x several days of moderate activity x 4.0. Moreover, vigorous-intensity activity energy expenditure (EEVIG) emerged from vigorous-intensity activity minutes x several days of vigorous-intensity activity x 8.0. Finally, the total PA energy expenditure (EETOT) was calculated as EEWALK+EEMOD+EEVIG reported in MET-h per week. The last items of the IPAQ also provided information about the hours/day spent in the sitting position, during the WEEK (SITW) and the weekend (SITWEND).

c) *Motivation to change PA habits* was assessed through the MAC (in Italian, 'motivazione al cambiamento') 2 R-PA and a set of six visual analog scales (VAS), two tools based on Prochaska's transtheoretical model [38, 39]. These measures allowed us to assess motivational profiles in terms of stages of change and motivational components. These measures were validated in a large study of adults [38], and also in people with non-communicable diseases (NCDs) [40,41]. As described by Spiller and coauthors [38], the MAC2 R-PA questionnaire consists of 18 items, rated on a Likert scale (ranging from 0 = "totally false" to 6 = "completely true"). It helps to ideally collocate the respondent into the five stages (precontemplation, contemplation, determination, action, and maintenance) described by Prochaska's model of the stages of change [39]; the highest score indicates the prevalent stage of change. The six VAS have a 100-point scale (ranging from 0 = "not at all true" to 100 = "extremely true") and they allowed us to evaluate the motivational components (Discrepancy, Importance, Self-Efficacy, Temptation) [38].

Statistical analysis

Quantitative variables were described by their mean and standard deviation (SD), and the qualitative variables with cross percentage tables. Data normal distribution was tested using the Kolmogorov - Smirnov test. According to distribution, the independent samples T-Test or the Mann–Whitney U test was performed to evaluate if studied subgroups (subjects who practice/do not practice physical activity regularly, men and women) presented differences. Then, the analysis of variance or Kruskal-Wallis test was used to study the differences comparing PAL (3 subgroups) and SIT (4 subgroups).

P-values < 0.05 were set as statistically significant. All the research data were stored anonymously in electronic worksheets, accessible only to personnel in charge of

research tasks within the study. Statistical analyses were conducted with SPSS®, version 25.0 for Windows (IBM Corp. Released 2017. IBM SPSS Statistics for Windows, Version 25.0. Armonk, NY, USA: IBM Corp.).

RESULTS

Anthropometric Measures

As regards the anthropometric measurements (Tables 1), the average weight found in the interviewed population was 72.44±11.91 kg for the whole group, with a statistically significant difference ($p<0.01$) between men (79.25±9.52 kg) and women (65.06±9.66 kg) subgroups. Height showed differences for gender ($p<0.01$). BMI showed that the whole group was of normal weight (24.54±3.2 kg/m^2) with a significant difference ($p=0.05$) for gender. In fact, men were in overweight status (25.17±2.82 kg/m^2), while women were of normal-weight status (23.86±3.45 kg/m^2). When considering whether respondents practiced physical activity, the data show that active subjects had better body weight ($p=0.04$) and BMI ($p<0.01$) than those who did not practice physical activity regularly. These differences were maintained within gender subgroups. Finally, there were significant differences between active men vs. active women and inactive men vs. inactive women (body weight, $p<0.01$ and BMI, $p=0.02$ for both pairs).

Self-Reporting Questionnaires Measures

General information

Health status. 54.8% of the group did not report particular pathologies (69.2% of respondents who regularly practice physical activity and 36.2% do not exercise regularly), while 11.1% suffered from low back pain, and 7.1% from osteoarthritis. With regard to non-communicable pathologies, 5.6% suffered from hypertension, and 10.3% presented hypercholesterolemia and hypertriglyceridemia.

Table 1. Anthropometric and self-report measures values for gender and physical activity subgroups

Indicator	Variables	Age		Weight (kg)		Height (m)		BMI	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender	Men (n=64)	40.25	±15.1	79.25	±9.52	1.78	±0.55	25.17	±2.82
	Women (n=59)	41.2	±14.15	65.06	±9.66	1.65	±0.55	23.86	±3.45
	p-value	0.6		<0.01*		<0.01*		0.05*	
Physical Activity	Active (n=65)	37.86	±14.32	70.2	±10.65	1.72	±0.08	23.07	±2.63
	Inactive (n=58)	43.9	±14.36	75	±12.81	1.71	±0.09	25.49	±3.52
	p-value	0.01*		0.04*		0.60		<0.01*	
Only Men	Active (n=36)	37.72	±14.36	76.17	±7.68	1.78	±0.05	24.15	±2.11
	Inactive (n=28)	43.5	±15.65	83.21	±10.30	1.77	±0.06	26.49	±3.10
	p-value	0.13		0.01*		0.82		<0.01*	
Only Women	Active (n=29)	38.03	±14.52	62.8	±9.1	1.65	±0.05	23.1	±3.1
	Inactive (n=30)	44.27	±13.31	67.2	±9.8	166	±0.06	24.6	±3.7
	p-value	0.06		0.04*		0.51		0.1	

TOTVIG= total weekly time in vigorous physical activity; TOTMOD= total weekly time in moderate physical activity; TOTWALK= total weekly time in walking activity; TOTPA= TOTVIG + TOTMOD + TOTWALK; EEVIG= total weekly vigorous physical activity energy expenditure; EEMOD= total weekly moderate physical activity energy expenditure; EEWALK= total weekly walking energy expenditure; EETOT= EEVIG+ EEMOD+ EEWALK; SITW= hours/day spent in the sitting position during the weekday; SITWEND= hours/day spent in the sitting position during the weekend. *Statistical significance was set for p-values ≤0.05; SD= standard deviation

Marital and working status. The general information collected by the participants in the study showed that 38.2% were single, 35% were married, 21.1% were cohabitants or civilly united with a partner, and 4.1% were separated or divorced. In terms of employment, data showed that 65% had a job, 20.3% were students, and 8.1% were retired.

Economic information and health care costs. In the sample, there was a higher percentage (19%) of people with a high family average monthly net income (more than 10,000 euros, with high differences for gender, to the benefit of the men's group). The other most significant incomes in percentage terms were in the categories between 1000 and 1999 euros (15.7%) and between 2000 and 3999 euros (15.7%). The healthcare costs incurred by the interviewees were in most cases (34.4%) in a range from 0 to 500 euros per year, while 23.8% instead spent from 500 to 1000 euros. The spending percentages from 1,500 to 2,000 euros and above 2,000 euros were the same, with 19.7% of respondents spending >1500 euros/year for health care.

"*Do you practice physical activity regularly?*". 52.8% of participants replied that they regularly exercised. 44.4% engaged in physical activity alone (48.6 men vs. 39.3% women), while 27.0% did so with friends (31.4 men vs. 21.4% women), and 23.8% with a personal trainer or kinesiologist (20.0% men vs. 28.6% women). Regarding the location of the physical activity, 64.1% reported in sports facilities (50.0% men vs. 82.1% women), 26.6 % reported outdoors (38.9% men vs. 10.7% women), and 7.8% reported at home (8.3% men vs. 7.1% women). Finally, 67.6% of participants believed that preventing pathologies and improving the quality of life were the main purposes of PA. On the other hand, among those who declared that they did not practice PA regularly, 33.3% stated that they did have not enough time (40.7% men vs. 26.7% women), 33.3% were not sufficiently motivated, and 22.8% reported sports facilities were too far or not accessible. Finally, over 85% (85.7% men vs. 86.7% women) of the participants stated that they would be willing to start physical activity, in an adequate structure, followed by specific specialists.

PAL and time in sitting activity (SIT)

Regarding the levels of PA (tables 2), we found relevance in the difference by gender, in TOTVIG ($p=0.03$), TOTMOD ($p=0.05$), TOTPA ($p=0.04$), and relatives energy expenditure (tables 3). These differences were confirmed between active and inactive subgroups. Considering only the men's subgroup, we observed significant differences in TOTVIG ($p<0.01$), EEVIG ($p<0.01$), and EETOT ($p=0.03$) between active and inactive participants. In the women's subgroups, we observed significant differences in TOTVIG ($p<0.01$), TOTMOD ($p=0.01$), TOTPA ($p<0.01$), and relatives energy expenditure. Comparing active men and women, as well as inactive men and women, no statistically significant differences were observed. Using PAL categories as a between factor (Table 6), we confirmed statistically significant differences between groups, as obviously expected. Using SIT categories (Table 7), we observed significant differences in TOTWALK ($p=0.024$) and TOTPA ($p=0.007$) and relative energy expenditure. Particularly, post-hoc analysis showed differences between very high SIT vs. low SIT subgroups and high SIT vs. low SIT subgroups. Finally, using BMI categories as a between factor (Table 8), statistically significant differences were observed in TOTVIG ($p<0.01$) and EEVIG ($p<0.01$), in obese vs > overweight participants.

Regarding SIT, the results did not show a difference between genders during weekdays (4.4±2.7) and weekends (4.1±2.5). All PAL and SIT data are reported in Table 2 and 3. In a post-hoc analysis, we observed statistically significant differences in SITW ($p=0.01$) between highPAL vs. lowPAL ($p=0.021$) and highPAL vs. moderatePAL ($p<0.01$) subgroups.

Motivation to change

Regarding motivation, the entire sample presented a high percentage in contemplation status (56.3±28.2), but showed medium scores in preparation (53.8±30.3)

and maintenance (50.1±38.1) status. A statistically significant difference was observed in the contemplation state (that was more evident in women, 62±25.7 than in men, 51±29.5). On motivational factors, we found higher average values in men regarding self-efficacy (70.8±20.5 vs. 59.2±23.4), and readiness to change (72.8±22.1 vs. 63.9±24.4). Motivation data are reported in Tables 4 and 5.

Table 2. Self-Report Questionnaires Measures: PAL and SIT values, for gender and physical activity subgroups

Indicator	Variables	TOTVIG (min/week)		TOTMOD (min/week)		TOTWALK (min/week)		TOTPA (min/week)		SITW (h/day)		SITWEND (h/day)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender	Men (n=64)	132.7	231.3	278.3	338.8	316	332.4	726.9	647	4.3	2.5	4.1	2.2
	Women (n=59)	73.1	153.1	176.6	258	254.8	272.8	504.6	476.4	4.5	2.9	4	2.8
	p-value	0.03*		0.05*		0.39		0.04*		0.96		0.35	
Physical Activity	Active (n=65)	182.8	243.3	251.2	293.2	289.4	280.3	723.4	571.7	4.4	2.7	3.8	2.3
	Inactive (n=58)	15.9	58.7	205.2	320.2	283.5	334.1	504.7	572.3	4.4	2.6	4.4	2.6
	p-value	<0.01*		0.01*		0.4		<0.01*		0.94		0.21	
Only Men	Active (n=36)	219.9	273.8	280.1	324.9	283.6	280.2	783.6	666	4.2	2.5	3.9	2.1
	Inactive (n=28)	20.5	66.7	275.9	361.9	357.5	390.9	653.9	626	4.6	2.4	4.4	2.3
	p-value	<0.01*		0.51		0.98		0.28		0.53		0.4	
Only Women	Active (n=29)	136.7	193.9	215.3	249.4	296.5	285.1	648.6	426.6	4.7	3.0	3.7	2.7
	Inactive (n=30)	11.7	50.9	139.2	264.9	214.5	258.6	365.4	487.2	4.2	2.8	4.3	2.9
	p-value	<0.01*		0.01*		0.23		<0.01*		0.6		0.38	

TOTVIG= total weekly time in vigorous physical activity; TOTMOD= total weekly time in moderate physical activity; TOTWALK= total weekly time in walking activity; TOTPA= TOTVIG + TOTMOD + TOTWALK; SITW= hours/day spent in the sitting position during the weekday; SITWEND =hours/day spent in the sitting position during the weekend; SD= standard deviation; *Statistical significance was set for p-values ≤0.05.

Table 3. Self-Report Questionnaires Measures: energy expenditure values, for gender and physical activity subgroups

Indicator	Variables	EEVIG (METs/h/week)		EEMOD (METs/h/week)		EEWALK (METs/h/week)		EETOT (METs/h/week)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender	Men (n=64)	17.7	30.8	18.6	22.6	17.4	18.3	53.6	50.2
	Women (n=59)	9.8	20.4	11.8	17.2	14	15	35.5	33.9
	p-value	0.03*		0.05*		0.39		0.03*	
Physical Activity	Active (n=65)	24.4	32.4	16.7	19.5	15.9	15.4	57	46.8
	Inactive (n=58)	2.1	7.8	13.7	21.3	15.6	18.4	31.4	36.4
	p-value	<0.01*		0.01*		0.4		<0.01*	
Only Men	Active (n=36)	29.3	36.5	18.7	21.7	15.6	15.4	63.6	55.3
	Inactive (n=28)	2.7	8.9	18.4	24.1	19.7	21.5	40.8	40.3
	p-value	<0.01*		0.51		0.98		0.03*	
Only Women	Active (n=29)	18.2	25.9	14.4	16.6	16.3	15.7	48.9	32.5
	Inactive (n=30)	1.6	6.8	9.3	17.7	11.8	14.2	22.6	30.6
	p-value	<0.01*		0.01*		0.23		<0.01*	

EEVIG= total weekly vigorous physical activity energy expenditure; EEMOD= total weekly moderate physical activity energy expenditure; EEWALK= total weekly walking energy expenditure; EETOT= EEVIG+ EEMOD+ EEWALK; SITW= hours/day spent in the sitting position during the weekday; SITWEND =hours/day spent in the sitting position during the weekend; SD= standard deviation, *Statistical significance was set for p-values ≤0.05.

Tables 4. Self-Report Questionnaires Measures: Motivation-to-change values. Stages of the change values for gender and physical activity subgroups

Indicator	Variables	Precontemplation		Contemplation		Preparation		Action		Maintenance	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender	Men (n=64)	14.7	18.5	51	29.5	55.6	30.4	25	30.4	55.7	37
	Women (n=59)	16.8	21.9	62	25.7	50.9	30.3	25.3	31.4	44.1	38.8
	p-value	0.78		0.04*		0.26		0.9		0.09	
Physical Activity	Active (n=65)	6.3	10.7	40.8	25.9	66.5	33.3	37.1	35.8	82.7	16.8
	Inactive (n=58)	26.3	22.9	73.7	19.1	39.5	18.2	11.8	15.5	13.7	15.2
	p-value	<0.01*		<0.01*		<0.01*		<0.01*		<0.01*	
Only Men	Active (n=36)	6.22	10	33.6	23.7	67.1	33.4	32.9	36	84.5	16.2
	Inactive (n=28)	25.5	21.2	73.5	19.2	42.5	18.9	14.9	17	18.7	18.1
	p-value	<0.01*		<0.01*		<0.01*		0.14		<0.01*	
Only Women	Active (n=29)	6.3	11.7	49.7	26	65.8	33.7	42.3	35.6	80.5	17.6
	Inactive (n=30)	27	24.7	73.93	19.4	36.6	17.3	8.9	13.5	8.9	10.1
	p-value	<0.01*		<0.01*		<0.01*		<0.01*		<0.01*	

SD= standard deviation *Statistical significance was set for p-values ≤0.05.

Tables 5. Self-Report Questionnaires Measures: Motivation-to-change values. Motivational components values for gender and physical activity subgroups

Indicator	Variables	Discrepancy		Importance		Self-Efficacy		Temptation		Readiness to Change		Stabilization	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Gender	Men (n=64)	51.3	26.1	80.5	20.9	70.8	20.5	32.6	24.6	72.8	22.1	63	32.3
	Women (n=59)	56.8	21.9	76.6	20.3	59.2	23.4	36.8	26.8	63.9	24.4	52.9	34.3
	p-value	0.32		0.23		0.01*		0.45		0.04*		0.09	
Physical Activity	Active (n=65)	42.1	21.6	90.7	12.4	81.1	12.2	21.6	20.9	83.1	15.4	81.1	17.2
	Inactive (n=58)	67.3	19.8	65.1	19.6	47.4	17.7	49.2	22.6	52.2	20.4	32.4	28.2
	p-value	<0.01*		<0.01*		<0.01*		<0.01*		<0.01*		<0.01*	
Only Men	Active (n=36)	37.7	20.7	90.6	13.1	84.1	11.4	19.4	18.8	85.3	13.4	81.7	16.8
	Inactive (n=28)	68.9	21.6	67.5	21.9	53.8	16.7	49.6	20.5	56.8	20.9	38.9	31.7
	p-value	<0.01*		<0.01*		<0.01*		<0.01*		<0.01*		<0.01*	
Only Women	Active (n=29)	47.5	21.8	90.7	11.8	77.5	12.4	24.4	23.2	80.3	17.4	80.3	17.8
	Inactive (n=30)	65.8	18.3	62.9	17.2	41.5	16.8	48.8	24.8	48	19.2	26.3	23.4
	p-value	<0.01*		<0.01*		<0.01*		<0.01*		<0.01*		<0.01*	

SD= standard deviation *Statistical significance was set for p-values ≤0.05.

Using PAL categories as a between factor (Table 6), we observed differences in contemplation (p=0.038, higher in lowPAL than moderate PAL subgroups), and maintenance (p<0.01, higher in highPAL than moderate and lowPAL subgroups). Moreover, statistically significant differences were observed in all the motivational components. Using SIT categories as a between factor (Table 7), no differences were observed.

Finally, using BMI categories as a between factor (Table 8), differences were observed in preparation (p=0.04, higher in normal weight than in overweight subgroups), and maintenance (p<0.01, higher in normal weight than in overweight subgroups). Moreover, statistically significant differences were observed in all the motivational components, except in discrepancy.

Table 6. ANOVA analysis: PAL, SIT, and motivation to change, using PAL factor

Indicator	Variables	PAL Subgroups						p
		Low PAL		Moderate PAL		High PAL		
		Mean	SD	Mean	SD	Mean	SD	
PAL	TOTVIG (min/week)	13	33.5	55.6	73.6	259	310.4	<0.01*
	TOTMOD (min/week)	16	33.6	160.9	142.7	513.9	413.4	<0.01*
	TOTWALK (min/week)	68.4	65.5	228.3	173.3	556.6	399.7	<0.01*
	TOTPA (min/week)	97.3	71.4	444.8	185.4	1329.4	593.9	<0.01*
	EEVIG (METs/h/week)	1.7	4.5	7.4	9.8	34.5	41.4	<0.01*
	EEMOD (METs/h/week)	1.1	2.2	10.7	9.5	34.3	27.6	<0.01*
	EEWALK (METs/h/week)	3.8	3.6	12.6	9.5	30.6	22	<0.01*
	EETOT (METs/h/week)	6.6	5.6	30.7	11.8	99.4	45.6	<0.01*
SIT	SITW (h/day)	4.9	3.3	4.9	2.6	3.2	1.9	0.01*
	SITWEND (h/day)	4.9	3.4	3.9	2.2	3.7	2.1	0.17
Stages of the change	Pre contemplation	21.9	21.6	12.2	14.6	17.1	25.9	0.1
	Contemplation	25.9	23.8	51.1	28.3	56.7	29.2	0.04*
	Preparation	48.1	23.4	56.1	30.4	54	34.9	0.52
	Action	17	21.5	26	30.5	30	36.4	0.25
	Maintenance	22.6	26.8	55.4	37	62.3	38.1	<0.01*
Motivational components	Discrepancy	65.7	21	55.2	21.6	42.9	26.8	0.01*
	Importance	73.5	18.6	76.8	21.1	85.8	19.7	0.04*
	Self-Efficacy	54.4	19.7	64.7	21.7	74.5	22.9	<0.01*
	Temptation	52.1	28.7	29.6	20.9	29.9	25.6	<0.01*
	Readiness to Change	58.5	24.5	70.5	19.5	72.9	27.6	0.04*
	Stabilization	41.9	34.4	59.3	30.6	68.6	33.7	<0.01*

Table 7. ANOVA analysis: PAL, SIT, and motivation to change, using SIT factor

Indicator	Variables	SIT Subgroups								p
		Low SIT		Medium SIT		High SIT		Very high SIT		
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	
PAL	TOTVIG (min/week)	156.8	265.9	78.6	121.5	64.4	132	62	77.6	0.16
	TOTMOD (min/week)	271.4	343.1	264.1	342.3	168.2	189.5	46	55.5	0.21
	TOTWALK (min/week)	375.1	377.1	305	215.1	198.3	174.1	96	111.9	0.02*
	TOTPA (min/week)	803.2	715.3	647.7	350.2	428.9	304.9	204	243.9	<0.01*
	EEVIG (METs/h/week)	20.9	35.5	10.5	16.2	8.3	17.6	8.3	10.4	0.16
	EEMOD (METs/h/week)	18.1	22.9	17.6	22.8	11.2	12.6	3.1	3.7	0.21
	EEWALK (METs/h/week)	20.6	20.7	16.8	11.8	10.9	9.6	5.3	6.2	0.02*
	EETOT (METs/h/week)	59.6	55.8	44.9	24.3	30.4	24.5	16.6	20.1	<0.01*
SIT	SITW (h/day)	2.1	1	4.6	0.6	7.0	0.9	10.5	1.3	<0.01*
	SITWEND (h/day)	3.4	2.3	3.6	1.6	4.5	1.9	8.1	3.4	<0.01*
Stages of the change	Precontemplation	17.3	23.2	9.6	12.5	16.1	18.2	16.6	21.3	0.5
	Contemplation	54.3	27.2	53.4	29.9	56.8	30.7	66.8	11.7	0.78
	Preparation	50.3	31.2	62.6	29.1	54	30.3	50	41.2	0.48
	Action	23.9	31.5	37.9	34.7	21.2	29.6	20	21.7	0.23
	Maintenance	51.3	41.1	61.1	34.2	47.2	37.7	51.8	37.1	0.63
Motivational components	Discrepancy	50	21.9	58.2	25.1	57.2	24.3	65	24	0.29
	Importance	78.2	22.1	89	12.1	74.2	20.8	77.4	19.4	0.06
	Self-Efficacy	66.1	23.5	70.6	21.7	62.3	20.8	65.6	31.5	0.62
	Temptation	31.7	22.7	32.2	28.2	38.5	24.5	36.8	32.2	0.59
	Readiness to Change	69	25.4	71.8	22.8	65.8	19.9	72	22.8	0.79
	Stabilization	59.2	34.1	61.4	31.1	52.7	35.2	66	38.5	0.72

TOTVIG= total weekly time in vigorous physical activity; TOTMOD= total weekly time in moderate physical activity; TOTWALK= total weekly time in walking activity; TOTPA= TOTVIG + TOTMOD + TOTWALK; EEVIG= total weekly vigorous physical activity energy expenditure; EEMOD= total weekly moderate physical activity energy expenditure; EEWALK= total weekly walking energy expenditure; EETOT= EEVIG+ EEMOD+ EEWALK; SITW= hours/day spent in the sitting position during the weekday; SITWEND =hours/day spent in the sitting position during the weekend; SD= standard deviation, *Statistical significance was set for p-values ≤0.05.

Table 8. ANOVA analysis: PAL, SIT, and motivation to change, using BMI factor

Indicator	Variables	BMI Subgroups						p
		Normal weight		Overweight		Obesity		
		Mean	SD	Mean	SD	Mean	SD	
PAL	TOTVIG (min/week)	150.1	235.9	41.3	106.9	19	24.6	<0.01*
	TOTMOD (min/week)	199.6	281.3	292	346.6	86	98.4	0.16
	TOTWALK (min/week)	281.7	276.1	287.7	349.1	348	343.8	0.9
	TOTPA (min/week)	631.4	579.2	621	605.4	453	385.7	0.8
	EEVIG (METs/h/week)	20	31.5	5.5	14.3	2.5	3.3	<0.01*
	EEMOD (METs/h/week)	13.3	18.8	19.5	23.1	5.7	6.6	0.16
	EEWALK (METs/h/week)	15.5	15.2	15.8	19.2	19.1	18.9	0.9
	EETOT (METs/h/week)	48.8	46.8	40.8	40.9	27.4	21.8	0.42
SIT	SITW (h/day)	4.2	2.9	4.8	2.5	3.8	0.7	0.51
	SITWEND (h/day)	3.8	2.5	4.6	2.4	3.3	1.5	0.18
Stages of the change	Precontemplation	13.1	20.1	19.9	20.6	15.2	9.2	0.2
	Contemplation	51.8	28.5	61.6	26.3	73.2	32	0.07
	Preparation	59.4	31.1	45.1	26.3	51.6	40.1	0.04*
	Action	27.3	33.1	21.9	26.3	23.4	39	0.64
	Maintenance	60.8	38.3	35.5	32.9	31.6	34.5	<0.01*
Motivational components	Discrepancy	51	24.7	57.9	23.2	61	25.5	0.26
	Importance	83.7	18.7	71.1	22.1	74	11	<0.01*
	Self-Efficacy	71.5	20.7	56.9	21.7	51	30.6	<0.01*
	Temptation	29.9	24.3	40.9	25.3	45	37.4	<0.05*
	Readiness to Change	75.6	21.8	58.9	21.2	56	36.5	<0.01*
	Stabilization	66.7	31.1	45.4	33.8	52	29.5	<0.01*

TOTVIG= total weekly time in vigorous physical activity; TOTMOD= total weekly time in moderate physical activity; TOTWALK= total weekly time in walking activity; TOTPA= TOTVIG + TOTMOD + TOTWALK; EEVIG= total weekly vigorous physical activity energy expenditure; EEMOD= total weekly moderate physical activity energy expenditure; EEWALK= total weekly walking energy expenditure; EETOT= EEVIG+ EEMOD+ EEWALK; SITW= hours/day spent in the sitting position during the weekday; SITWEND =hours/day spent in the sitting position during the weekend; SD= standard deviation; *Statistical significance was set for p-values ≤0.05.

DISCUSSION

This study aimed to estimate the PA levels (PAL), the sedentary time, and the motivational aspects linked to lifestyle, in a group of 123 healthy Italian adults who participated in an online survey. The population highlighted in this study was inactive, normal weight (men were in overweight status), and had no serious health conditions. In fact, 53.7% of participants had no pathologies. Only 11.4% of respondents reported having low back pain, 10.6% hypercholesterolemia/hypertriglyceridemia, 5.7% hypertension, and 0.8% diabetes: the latter clinical conditions represent risk factors for cardiovascular diseases, exercise sensible, as observed in our previous studies [42-45]. This population is critical and strategic for targeting people who may be at the tipping point of developing chronic health problems without sustained behavior change. For such a population it is necessary to plan preventive, multidisciplinary healthy lifestyle education interventions to control the risk of non-communicable disease.

In our study, 47.2% of participants reported that they do not practice regular physical activity. These data are in line with the Eurobarometer 2022 data [46] that showed that 45% of Europeans declare that they never exercise or participate in sporting activities. In the European Commission survey, 56% of Italians say they never exercise and 46% of Italians state that they do not practice physical activities (such as cycling from one place to another, dancing, gardening) other than sports. Moreover, our data are in line with the surveillance system PASSI (Progressi delle Aziende Sanitarie per la Salute in Italia) [47] data, that described 47% of the Italian population as physically active (vs

52.8% of our survey), while 24% are partially active (defined as "a person who does not do physically strenuous work but does some physical activity in his spare time, without however reaching the levels recommended by the guidelines").

The main barriers to practicing PA also coincide with previous study data [48, 49]: lack of time, followed by lack of motivation. In our study, 33.3% of inactive people reported that they had no time to engage in PA, 33.3% declared that they were not motivated enough, and 22.8% complained about problems with the availability of sports facilities (too far away or not accessible). This last point is in line with the data of The Value of Sport Observatory that explained that Italy, to date, has an infrastructural endowment in the sports sector of 131 facilities for every 100,000 inhabitants, 58% less than that of France and 4.6 times less than Finland (the most active country in the EU), and with profound territorial differences (the North has plant equipment 35% higher than that of the South). Furthermore, among the sports facilities present and active in the area, 60% were built more than 40 years ago [50]. This situation could be one of the causes of the reduced PA level in Italy. In fact, easy accessibility to facilities is a crucial component in PA promotion. For example, the study of Eriksson and coauthors [51] showed a link between PA levels and objective availability of exercise facilities, revealing that people who lived near exercise facilities had a higher level of MVPA and higher adherence to PA guidelines than participants who do not have exercise facilities close to where they lived. Thus, increasing exercise facilities in Italy could improve PA levels across the population and reduce sedentary-time-related consequences for health. Another possible solution to combat sedentary time and low PA levels, especially due to lack of time, is to promote exercise with online training [52-54]. Indeed, due to the innovations in electronic devices and the widespread adoption of online technologies, training has been integrated into online applications, web-based channels, and online platforms [55, 56,]. Additionally, specialized active video games, known as "exergames," have been created to bridge the gap between exercise training and online technologies. Moreover, online training and exergames have been shown to be effective also in improving motivation [27].

The desired increase in motivation to carry out a physical activity should be autonomous [57], allowing greater adherence to the program with gradual transitions between the five phases of change (pre-contemplation, Contemplation, Preparation, Action, and Maintenance). Autonomous motivation would not only increase the PAL but also guarantee regularity in carrying out a physical activity program, a vital aspect for obtaining results that would improve the health of citizens [58,59].

In line with a previous study [46, 60, 61], among factors stimulating the practice of PA, the participants in our interview communicated the importance that physical activity has for them in preventing the onset of pathologies and maintaining health (67.6%) and the importance of having adequate sports facilities and specialists dealing with physical exercise (85%). Other studies focused on political intervention to overcome cost barriers with financial incentives and vouchers but their effectiveness is currently debated [62]. This aspect is important as it is known that among the main obstacles to participation in PA is the economic problem of the costs to be incurred [63]. Families with low socioeconomic status experience prohibitive costs associated, for example, with PA enrolment and equipment [64,65]. However, none of the participants indicated the economic aspect among the reasons for not practicing PA, which accords with the fact that 34.7% of the participants also declared having a medium-high monthly family income.

The subjective perception of the level of physical activity practiced does not always correspond to that actually performed: As well stated by the Istituto Superiore di Sanità [48], 1 out of 2 partially active adults and 1 out of 5 sedentary adults perceive their level of physical activity as sufficient. In our study this aspect is controversial and people who declared themselves to be inactive then proved themselves wrong when answering the Ipaq questionnaire.

Strengths and Limitations

In our opinion, the greatest limitation of the present study is represented by the fact that the results emerge from self-reported information by the people who responded to the questionnaires. The critical issues linked to these investigation tools are well-known in the literature. From a certain point of view, however, the choice of tools also represents a strong point of the paper, as validated and widely used questionnaires in research were selected. Certainly, in future studies, it could be of great help to implement the use of objective methods for detecting the PA, including sedentary time, practiced (for example accelerometers, etc.). Additionally, the number of participants who responded to all the questionnaires represents another strong point.

CONCLUSION

In summary, the present study shows that the motivation to engage in physical activity has a close link with parameters related to health and well-being. It is also confirmed that the various phases that characterize the change are linked to the levels of physical activity actually achieved. Therefore, in order to promote greater health among citizens, public information campaigns aimed at raising public awareness of the need to increase PA must also address motivation and how it can be improved in order to achieve the final phases of action and maintenance.

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