Quality of life and stages of behavioural change for physical activity in people motivated to reduce their cardiovascular risk

Kalp ve damar risklerini düşürme motivasyonu olan bireylerde yaşam kalitesi ve fiziksel aktivite davranişlari değişikliği

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Abstract

Regular physical activity has been shown to be associated with improved quality of life (QoL). However, systematic investigations of the association between motivational stages of change for physical activity and different domains of QoL are lacking. A randomized controlled trial was conducted to improve physical activity and fruit and vegetable consumption in Germany and the Netherlands (N = 790) participants. The mean age was 50.9 years (SD = 12.2, Range: 20-84), 62.9% (N = 497) of the participants were female. Besides socio-demographic information, QoL, physical activity, the stage of change for exercise, and body mass index (BMI) were obtained via a web-based self-report. There were significant interrelations of stages of change for activity with the different domains of physical, psychological, social relations, and environment QoL (Wilks λ = .94, df = 12, p < .001). Study participants of the maintenance group showed highest QoL levels across all domains, while the pre-contemplators/contemplators showed the lowest QoL values. The relationship between the stage of change and QoL was different among BMI groups. Healthcare providers should individually encourage people to attain higher stages of change for physical activity due to the association with both, a higher QoL and lower BMI and should give personalised feedback on physical activity levels. However, there is a need for further longitudinal studies to acquire a more complete understanding of long-term mechanisms of stage of change for physical activity, BMI and QoL.

Keywords: Physical activity; stage of change; QoL; tailored feedback

Özet

Düzenli fiziksel aktivitenin iyileştirilmiş yaşam kalitesi (QoL) ile ilişkili olduğu görülmüştür. Fakat, fiziksel aktiviteye duyulan motivasyon evrelerindeki değişiklik ile QoL'in farklı alanları arasındaki ilişki hakkında sistematik araştırmalar yeterli oranda bulunmamaktadır. Almanya ve Hollanda'dan (N = 790) katılımcı ile fiziksel aktivite ve meyve ve sebze tüketimini artırmak için tam kontrollü bir araştırma yürütüldü. Katılımcıların yaş ortalaması 50.9'dur (SD = 12.2, Range: 20-84), katılımcıların % 62.9'u (N = 497) kadınlardan oluşmaktadır. Internet tabanlı öz-bildirim yolu ile sosyo-demografik bilgilerin yanında, QoL, fiziksel aktivite, egzersiz değişiklik evresi ve vücut kitle indeksi (BMI) hakkında veri toplanmıştır. Fiziksel, psikolojik, sosyal ilişkiler, ve çevre QoL ile (Wilks λ = .94, df = 12, p < .001) aktivite değişikliği evreleri arasında anlamlı ilişkiler bulundu. Devam edenler grubundakiler tüm alanlarda en yüksek QoL oranlarını gösterdiler. Gözden geçirenler ve gözden geçirmenin ön aşamasında olanlar ise en düşün QoL oranlarını gösterdiler. Sağlık hizmeti sunanlar, bireysel olarak kişileri hem yüksek QoL ile hem de düşük BMI ile ilişkili olan fiziksel aktivite değişikliği için motive etmeliler ve fiziksel aktivite düzeyleri hakkında kişisel geribildirim vermeliler. Fakat, fiziksel aktivite, BMI ve QoL'nin uzun vadeli mekanizmalarının daha kapsamlı bir şekilde anlaşılmasını sağlamak için boylamsal çalışmalara ihtiyaç duyulmaktadır.

Anahtar Kelimeler: Fiziksel aktivite, değişim evreleri, QoL, özel geribildirim

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Introduction

Regular physical exercise is well known to have a positive effect in the primary and secondary prevention of cardiovascular diseases such as high blood pressure (Hamer, Tailor, & Steptoe, 2006; Pal, Radavelli-Bagatini, & Ho, 2013), diabetes mellitus (Dagfinn, Norat, Leitzmann, Tonstad, & Vatten, 2015; Cooper et al., 2014) and coronary heart disease (Gielen, Laughlin, O'Conner, & Duncker, 2015; Sattelmaier et al., 2011). While morbidity and mortality benefits have been carefully examined, quality of life (QoL) has attracted less attention when evaluating the effects of physical activity programs, although the results are promising (Gielen et al., 2015). A promoted line of research seeks to extend beyond the straightforward division between physically active and sedentary individuals, striving to explore the determinants of motivational readiness based upon underlying continuum of stages of change. In the Transtheoretical Model of Change (TTM), Prochaska and DiClimente (1983) suggest that individuals typically progress through a series of five stages in terms of behaviour change. Here, the readiness to change one's behaviour spans from pre-contemplation (not intending to change), contemplation (intending to change in the next 6 months), preparation (intending to take action in the immediate future), action (having recently changed one's behaviour, defined as within the last 6 months) to maintenance (sustaining one's behaviour change for a while, defined as more than 6 months). Given that adapting the self-perception concerning the benefits of regular physical activity reflects a central motivational strategy in many activity-promotion interventions (Greaves et al., 2011), studying whether – and to what degree – the self-perception of QoL varies across the different behaviour change stages through which an individual progresses holds strong importance.

One possible barrier to regular physical activity is that sedentary individuals may be unaware of their inactivity. Rising levels of inactivity over the last years may have worsened peoples' ability to distinguish low from sufficient physical activity levels creating the perception that sedentary lifestyles are socially accepted. Evidence from studies that compare self-report with objective physical activity data indicates that between 48% and 61% of adults, who do not currently meet recommended guidelines, overestimate their levels of physical activity and refer to themselves as actor or maintainer within the TTM (Ronda, van Assema, & Brug, 2001; van Sluijs, Griffin, & van Poppel, 2007; Watkinson et al., 2010). In addition, van Sluijs et al. (2007) argue that an overestimation of one's own behavior is especially prominent in those with lower self-efficacy, perceived social support and negative attitudes, eventually leading to mental health problems.

Thus far, no studies have examined the relationship between physical activity stage of change and QoL in motivated people who want to reduce their cardiovascular risk. One related study was conducted in the general population (Laforge et al., 1999), one involed lung cancer survivors (Clark et al., 2008), and two involved only overweight and obese adults (Romain et al., 2012; Lee, Chang, Liou, & Chang, 2006). They all concluded that people who reported exercising on a regular basis also had better QoL, with a peak occurring in the action stage. In addition, as being overweight has been found to be an independent risk factor for both cardiovascular diseases (Bastien, Poirierm, Lemieux, & Després, 2014) and limited QoL (Renzaho, Wooden, & Houng, 2010), it is important to consider the relationship between physical activity and QoL across different BMI groups.

The present study aims to expand on the literature on physical activity and QoL by examining the relationship between stages of physical activity and the self-reported QoL among people who are motivated to reduce their cardiovascular risk. We hypothesize that the higher people are according to the stage of change for physical activity, the higher their reported reported QoL in all domains (*hypothesis 1*). In addition, we suggest that the relationship between stage of change and QoL domains is significantly different according to BMI groups (*hypothesis 2*).

Methods

Study Design

This study was designed as a randomized control trial (RCT) to investigate whether a web-based computer-tailored intervention is effective in increasing self-reported physical activity and fruit and vegetable consumption. The baseline questionnaire (T0) was the same for the intervention and waiting control group; thus, we expect no differences in results due to group condition. Indeed, we are interested in differences in self-reported QoL according to stages of change for physical activity; the effectiveness of the behaviour change intervention does not hold interest in this study. We therefore do not analyse the behaviour changes over time. Specific information on the study design can be found in Reinwand et al. (2013).

Ethical Approal

The study was registered at ClinicalTrials.gov (Identifier: NCT01909349) and received ethical approval by the Deutsche Gesellschaft für Psychologie in Germany (EK-A-SL022013) and the Medical Ethics Committee of Atrium Medical Centre Heerlen in the Netherlands (12-N-124).

Participants and Procedure

Data collection took place from July 2014 until February 2015 in Germany and the Netherlands. In total, $N = 1,010$ study participants were recruited by the researcher team in cardiac rehabilitation facilities, heart training groups, online panels and internet platforms in Germany and the Netherlands. Participation in the study was voluntary and data were anonymized. The inclusion criteria were as followed: being at least 20 years old, no contraindications for physical activity and fruit and vegetable consumption, having interest in reducing cardiovascular risk by improving physical activity and fruit and vegetable consumption, sufficient reading and writing skills in the relevant language, and internet access. $N = 220$ data sets were excluded by the research team due to double registration ($n = 5$), missing gender information ($n = 86$), inadequate age ($n = 1$ younger than 20 years), and those who did not provide any self-report data ($n = 128$). Therefore, the final sample size comprised $N = 790$ participants at baseline (T0).

Measurement Instruments

Socio-demographic information. All socio-demographic information such as gender (1 = male, 2 = female), year of birth, country of birth (1 = Netherlands, 2 = Germany), employment status (1 = working part-time, 2 = working full-time, 3 = in training, 4 = unemployed, 5 = retired, 6 = housewife/houseman), marital status (1 = single, 2 = close relationship but not living together, 3 = close relationship and living together, 4 = marital partnership/common law marriage, 5 = divorced, 6 = widowed), and highest level of education (1 = no school graduation yet, 2 = primary school education, 3 = secondary school education, 4 = vocational school graduation, 5 = university entrance diploma, 6 = other) were measured via a web-based self-report. The same holds true for the following variables.

Quality of Life (QoL). QoL was determined by means of the short version of the World Health Organization Quality of Life (WHOQOL-BREF) Questionnaire (Group WHOQOL, 1993; Hsiao, Wo, & Yao, 2014; Skevington, Lotfy, & O'Connell, 2004; Trompenaars, Masthoff, van Heck, Hodiamont, & de Vries, 2005). The WHOQOL-BREF was developed to assess QoL in a cross-culturally comparable way. Analyses of internal consistency, item–total correlations, discriminant validity and construct validity indicate that the WHOQOL-BREF has good to excellent psychometric properties of reliability and validity (Hsiao, Wo, & Yao, 2014; Skevington, Lotfy, & O'Connell, 2004; Trompenaars et al., 2005). The WHOQOL-BREF covers four domains

of QoL: physical, psychological, social, and environment. These WHOQOL-BREF items all inquire 'how much', 'how completely', how often', 'how good' or 'how satisfied' the respondent felt in the last two weeks.

Physical QoL was assessed via the use of seven items (Cronbachs α = .81) such as "To what extent do you feel that physical pain prevents you from doing what you need to do?". *Psychological* quality of life was measured with six items (Cronbachs α = .81) such as "To what extent do you feel your life to be meaningful?". QoL regarding *social relations* was assessed by three items (Cronbachs α = .64) such as "How satisfied are you with the support you get from your friends?". Eight items (Cronbachs α = .79) such as "To what extent do you have the opportunity for leisure activities?" were used to measure *environment* QoL. Study participants indicated their answers on different five-point-scales ranging from not at all (1) to completely (5), very dissatisfied (1) to very satisfied, not at all (1) to an extreme amount (5), not at all (1) to extremely (1), very poor (1) to very well (5) and never (1) to always (5). Three of the items were reversed before scoring. According to the WHOQOL-BREF scoring protocol, the four domains are subsequently scored, labeled and transformed to a 0 to 100 scale used to interpret and compare to other validated instrument tools such as the WHOQOL-100. The four domain scores are scaled in a positive direction, with higher scores indicating a higher quality of life.

Body Mass Index (BMI). Weight (in kg) and height (in cm) were assessed to calculate participants' BMI. According to the World Health Organization (2006), a BMI of 18.5 to 24.9 is considered normal weight, 25.0 to 29.9 falls within the overweight range, and a BMI of 30 or higher or higher falls within the obese I (30 to 34.9) or obese II (35 to 39.99) category. To obtain equal sample sizes per BMI group we merged those with a BMI higher than 30 into one group.

Stage of Change. The stage of change for physical activity was assessed with the item: "Please think about your typical week: Do you engage in physical activity at least 5 days per week for at least 30 minutes?" (Lippke, Ziegelmann, Schwarzer, & Velicer, 2009). Participants indicated their answer on a rating scale with verbal anchors "No, and I do not intend to start" (*Pre-contemplation stage*); "No, but I am considering it" (*Contemplation stage*); "No, but I seriously intend to start" (*Preparation stage*); "Yes, but only for a brief period of time" (*Action stage*); "Yes, for a long period of time" (*Maintenance stage*). Due to the small number of participants in the pre-contemplation stage ($n = 19$), pre-contemplators and contemplators were merged into one group to have equal sample sizes per stage group.

Data Analysis

Preliminary analysis. Data analysis was conducted with SPSS 22. Correlation analyses and chi²-tests were performed to detect country differences between the categorical variables stages of change for physical activity, and BMI groups. T^2-tests were undertaken to compare country differences regarding age and QoL.

Main analysis. As indicated by the Levene test, homogeneity of variances was not given for the dependent variables physical ($F(4, 785) = 6.62$, $p < .001$), psychological ($F(4, 785) = 9.43$, $p < .001$), social relations ($F(4, 785) = 8.40$, $p < .001$), and environment ($F(4, 785) = 12.76$, $p < .001$) QoL. We used a one-way MANCOVA, ANCOVA and the Games-Howell post-hoc comparisons to analyze variations on the QoL scores for the different stages of change for physical activity (*hypothesis 1*) and whether the relationship between stage of change and QoL is different according to BMI groups (*hypothesis 2*).

The Games-Howell test is recommended if the homogeneity of variances assumption is violated (Games & Howell, 1976; Jaccard, Becker, & Wood, 1984). As we simultaneously compared four sub-scales across stages of change, the Bonferroni adjustment for multiple comparisons was performed and a significance level of $p = .01$ was used. Age, gender, country,

employment status, marital status and highest level of education were included as covariates in all analyses. Furthermore, a p value of .05 was defined as level of significance for all analyses besides of the Games-Howell post hoc analyses were a p value of .01 was defined as level of significance. Polynomial contrast analyses were used to test for nonlinear trends, i.e. quadratic and cubic terms. The trends were tested with adjustment (weighted terms) for unequal sample sizes. Trends and planned contrasts were computed in line with Winer, Brown, and Michels (1991). Reported contrast effect sizes are presented as *r*. According to Cohen (1988) effect sizes ranging from .00 to .20 are considered small, those from .20 to .33 are considered medium and those bigger than .33 are referred to as large.

Results

Descriptive Information

Sample Characteristics. The final sample comprised N = 790 participants. All descriptive results including baseline equivalency are portrayed in Table 1.

Table 1. *Descriptive information on main study variables* (N = 790)

	Total (N = 790)	German (N = 371)	Dutch (N = 419)		
	n (%)	*n* (%)	*n* (%)	chi²	*p*
Stages of change				24.21	< .001
PC / C	155 (19.6)	59 (15.9)	96 (22.9)		
P	308 (39.0)	164 (44.2)	144 (34.4)		
A	125 (15.8)	73 (19.7)	52 (12.4)		
M	202 (25.6)	75 (20.2)	127 (30.3)		
BMI				7.66	.022
Normal weight	231 (29.2)	99 (26.7)	132 (31.5)		
Overweight	370 (46.9)	167 (45.0)	203 (48.4)		
Obese I - III	189 (23.9)	105 (28.3)	84 (20.0)		
	M (SD)	*M (SD)*	*M (SD)*	*t*	*p*
Age	50.85 (12.15)	52.18 (11.18)	49.67 (12.85)	8.51	.004
Physical Activity	576.43 (568.04)	699.17 (636.78)	467.75 (474.28)	34.03	< .001
QoL					
Physical	68.44 (16.14)	71.44 (15.50)	65.79 (16.24)	24.79	< .001
Psychological	63.21 (15.11)	64.11 (16.13)	62.42 (14.11)	2.45	.118
Social Relations	60.38 (18.21)	58.89 (18.84)	61.69 (17.54)	4.67	.031
Environment	73.62 (12.24)	76.10 (12.61)	71.44 (11.48)	29.56	< .001

Note: [1]N = 766; PC = Pre-contemplation stage; C = Contemplation stage; P = Preparation stage; A = Action stage; M = Maintenance stage; QoL = Quality of Life; numbers in parentheses are standard deviations;

Preliminary Analysis

Age was positively associated with psychological QoL (r = .12, p = .001) and environment QoL (r = .12, p = .001). This means that in this sample, older people tend to have higher psychological and environment QoL. BMI was negatively associated with physical QoL (r = -.14, p < .001), psychological QoL (r = -.16, p < .001), social relations QoL (r = -.13, p < .001), and environment QoL (r = -.13, p < .001). QoL scores were lower among people with higher BMI. In addition, all QoL domains were positively correlated with each other (r > .41, p < .001), indicating that high values in one QoL domain are associated with high values in another QoL domain.

Main Analysis

To test our *hypothesis 1*, we analyzed variations on the QoL scores for the different stages of change. The MANCOVA results revealed significant effects with stages of change for physical activity in relation to the four domains of the WHOQOL-BREF questionnaire (Wilks λ = .94, df = 12, p < .001). Games-Howell post-hoc comparisons, p values for all ANCOVA results as well as linear, quadratic, and cubic terms are shown in Table 2.

Overall, study participants of the maintenance group showed the highest QoL levels across all domains, while the pre-contemplators/contemplators showed the lowest QoL values across all domains. Significant differences occurred when comparing pre-contemplators/contemplators with the maintainers regarding physical, psychological, social and environment QoL. In addition, preparers scored higher on physical, psychological and social relations QoL, but not environment QoL. There were significant linear trends for all of the QoL domains, indicating that the higher the stage of change, QoL increased proportionately. For environment QoL there was also a significant cubic trend, with high QoL levels in both preparers and maintainers. To test our *hypothesis 2*, we investigated whether the differences in QoL according to stage of change might also depend on people's BMI group (Table 3).

Maintainers showed highest levels of QoL across all QoL dimensions, irrespective of BMI group. There were no significant associations between QoL and stage of change in normal weight people. However, we found significant differences in the association of QoL and the stage of change among overweight and obese people: Overweight pre-contemplators and contemplators showed significantly lower levels of psychological and social relations QoL than those in the maintenance group. In addition, the overweight preparers also showed significantly lower levels of psychological and social relations QoL than those in the maintenance group. Obese pre-contemplators and contemplators showed significantly lower levels of physical QoL. There were no weight-specific differences in the association between environment QoL and stage of change.

Discussion

The main aim of this study was to examine the relationship between motivational stage of change for physical activity and the self-reported QoL among people who were motivated to reduce their cardiovascular risk. In this study, we proceeded beyond the simple distinction between physically active and inactive individuals. We rather made an attempt to understand the determinants of motivational readiness to change along an underlying continuum of stages of change of the TTM (Prochaska & DiClimente, 1983), ranging from pre-contemplation (not intending to change) to maintenance (regular physical activity over time).

In our sample, more than half of the adults were not physically active regularly and were not even considering starting to do so. Therefore, a markedly high percentage were not in the stage of being physically active for at least five days a week for 30 minutes. Similar results are found in an other study that investigates physical activity behaviour in the adult population (Monette, Baird, & Jackson, 2014). However, they had a fairly strong intention to be physically active, with 39.0% of

them in the preparation stage (having the intention to start being physically active within the next 30 days) and a further 17.2% in the contemplation stage (having the intention to start being physically active within the next 6 months). This finding is in line with the data from Lee et al. (2006) and shows that it is essential to focus on how to provide appropriate guidance to people who are motivated to reduce their cardiovascular risk through regular physical activity.

Older people reported higher levels of QoL. Although older age is often associated with lower levels of cognitive function (Knopman et al., 2001; Kelly et al., 2014), slight improvement in mental health in older subjects is possible, especially when supported by physical activity training (Korhonen, Tellervo, Järvenpää, & Kautiainen, 2014).

Like in the investigations conducted by Korhonen et al. (2014) and Renzaho et al. (2010), we discovered that QoL and BMI were negatively related, whereby the greater the BMI, the lower the physical, psychological, social relations, and environment QoL. In fact, Cameron et al. (2012) suggest that the relationship between obesity and QoL is bi-directional: in a longitudinal study, they found that QoL was also a predictor of weight gain over the course of the years. Future studies should attempt to further investigate the direction of the effect of physical activity by using randomized controlled trials.

Four previous studies have examined the effects of stage of change on QoL among the general population (Laforge et al., 1999), among lung cancer survivors (Clark et al., 2008) and overweight and obese adults (Romain et al., 2012; Lee et al., 2006). They all concluded that people who reported being physically active on a regular basis also had better self-reported QoL, with a peak occurring in the maintenance stage. However, to our knowledge, no studies to date have used the TTM with the WHOQOL-BREF questionnaire as a reliable instrument that tends to produce fewer ceiling and floor effects (Hsiao et al., 2014; Skevington et al., 2004; Trompenaars et al., 2005). In line with the aforementioned studies, we could show that progression through the physical activity stages is related to higher physical, psychological, social relations and environment QoL. We found statistically significant differences in all QoL domains when comparing inactive people (pre-contemplators/contemplators) with people with sustained physical activity (maintainers).

So far, the relationship between QoL and stage of change among different weight groups has been unattended. Among our sample, the association between QoL and stage of change was different for normal weight, overweight and obese people: Overweight people who were already exercising on a regular basis (maintainers) showed higher levels of psychological and social relations QoL than both those who did not consider to start doing so (pre-contemplators/contemplators) and those who were preparing to do so (preparers).

In obese people, stage of chance was associated with QoL in the physical domain only. Obese but regularly active people (maintainers) reported significantly higher physical QoL than obese people who did not intend to start exercising (pre-contemplators/contemplators). QoL was not associated with stage of change among people with normal weight. One could assume that the obesity group could profit from regular physical activity in a two-fold manner: first, in terms of reducing their risk of future cardiovascular diseases through weight management; and second, regarding their psychological and social relations QoL levels.

Since environment QoL did not yield significant differences with regard to motivational stages among the three BMI grousps and only marginally significant differences between motivational stages alone. While the relationship between physical activity and physical QoL, psychological QoL and social relations QoL is well documented (Bize, Johnson & Plotnikof, 2007), environment QoL might be influenced by other factors than physical activity.

Table 2. *Analysis of QoL mean values and standard deviations per QoL dimension according to stages of change* (N = 790)

Measure	PC / C	P	A	M			Linear Term	Quadratic term	Cubic Term
	n = 155	n = 308	n = 125	n = 202				F (r)	
	M (SD)	M (SD)	M (SD)	M (SD)	p	GH[1]	F (r)		F (r)
Physical QoL	65.12 (16.31)	67.34 (14.40)	68.40 (18.42)	72.72 (16.23)	< .001	PC / C < M, P < M	21.83** (0.61)	0.48 (0.01)	0.41 (0.01)
Psychological QoL	59.65 (17.00)	61.28 (12.65)	63.70 (15.79)	68.59 (15.22)	< .001	PC / C < M, P < M	39.07** (0.81)	2.03 (0.07)	0.12 (< .01)
Social Relations QoL	57.20 (20.48)	58.47 (15.27)	60.47 (18.84)	65.68 (19.06)	< .001	PC / C < M, P < M	23.81** (0.65)	1.97 (0.07)	0.17 (< .01)
Environment QoL	70.83 (11.59)	74.29 (10.00)	72.30 (15.79)	75.63 (12.92)	.003	PC / C < M	9.27* (0.33)	< 0.01 (< .01)	6.84* (0.24)

Note: QoL = Quality of Life; PC = Pre-contemplation stage; C = Contemplation stage; P = Preparation stage; A = Action stage; M = Maintenance stage; [1]Games-Howell post-hoc test, with significance at .01; r = contrast effect size; * p < .05, ** p < .001

Table 3. Analysis of QoL mean values and standard deviations per QoL dimension according to stages of change (N = 790) per BMI Group

Measure	PC / C	P	A	M	p	GH[1]
Normal weight: 18.0 – 25.0, *n* = 231	*n* = 52	*n* = 68	*n* = 35	*n* = 76		
Physical QoL	57.51	69.49	66.33	73.45	.096	
Psychological QoL	64.34	62.19	63.45	68.97	.036	
Social Relations QoL	63.14	59.07	59.05	66.01	.107	
Environment QoL	72.90	74.13	72.68	76.48	.255	
Overweight: 25.1 – 30.0, *n* = 370	*n* = 66	*n* = 166	*n* = 48	*n* = 90		
Physical QoL	67.21	68.35	70.24	72.14	.090	
Psychological QoL	60.35	62.58	62.41	70.14	< .001	PC / C < M, P < M
Social Relations QoL	56.19	59.29	61.28	68.06	< .001	PC / C < M, P < M
Environment QoL	71.50	75.55	72.92	75.45	.028	
Obese I to III: 30.1 – maximum, *n* = 189	*n* = 37	*n* = 74	*n* = 42	*n* = 36		
Physical QoL	58.01	63.08	68.03	72.62	.007	PC / C < M
Psychological QoL	51.81	57.55	63.38	63.89	.005	
Social Relations QoL	50.68	56.08	59.71	60.02	.175	
Environment QoL	66.72	71.45	71.28	74.31	.211	

Note: QoL = Quality of life; PC = Pre-contemplation stage; C = Contemplation stage; P = Preparation stage; A = Action stage; M = Maintenance stage; numbers in parentheses are standard deviations; [1]Games-Howell post-hoc test, with significance at .01.

Our study has some limitations; for instance, the small percentage in the pre-contemplation stage prompted us to merge them with those in the contemplation stage, which precludes any specific interpretation for each of these groups. Furthermore, our study participants form a rather heterogeneous group. Although baseline intentions and socio-demographic data was controlled for in all analyses, a physician rating, medical diagnosis or objective index of medical severity should be included to control for in future studies. Finally, as our study is cross-sectional, the presence of an association between physical activity and QoL does not allow an interpretion of a potential causal relationship. We suggest an experimental design for future studies, investigating the effect of physical activity on QoL, as evidence of causality can only be obtained from an interventional study. Indeed, it is possible that higher QoL positively influenced the motivation to change one's activity behaviour and not vice versa.

Conclusion

The results of our study suggest that interventions aimed at increasing physical activity in the studied population should be both aimed at increasing awareness of personal activity levels and matched to an individuals motivational change of change. Although the majority of the overweight and obese adults in the present study were not in the habit of exercising regularly, they showed motivation to be physically active. The positive association between physical activity and QoL seems to be specifically relevant in overweight and obese individuals, and these could be target groups for preventive and therapeutic interventions that aim at improved QoL. The TTM highlights the role of verbal communication and cognitive processing in the early stage of changes (pre-contemplation and contemplation) are important. Accordingly, health professionals must be properly trained to provide tailored advice to people at varying stages of change, with the benefits of effectively incorporating physical activity into their daily routines, reducing cardiovascular risk factors and enhancing the QoL. However, a causal effect of physical activity stage of change on QoL over time needs to be replicated in further studies considering longitudinal experimental designs.

Compliance with Ethical Standards

All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards. Informed consent was obtained from all individual participants included in the study.

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