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Title:

Associations between social support and recommended physical activity level among patients with metabolic syndrome who received physical activity on prescription

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Abstract:

Aim: Lifestyle related diseases are major contributors to the global burden of disease and their inverse relationship with physical activity is widely accepted. However, research on the association between physical activity and mediators who could increase the physical activity level is still limited. Physiotherapists are concerned to identify the needs and resources of their patients. The purpose of this study was to investigate associations between social support and the achievement of a recommended level in a group of patients with metabolic syndrome. *Methods:* Data were collected at primary health care centers in Gothenburg. In total 402 patients between 27 and 80 years of age were included and answered a questionnaire on physical activity and various covariates at baseline, 330 patients were re-interviewed after six month (missing cases:18%) . Social support in association with physical activity level was analyzed using logistic regression. *Results:* The main finding of this study was that there are associations between social support and the recommended physical activity level when data is analysed on a subgroup level. Males had significantly higher odds to achieve the recommended level of physical activity with the support of family. A further sub-group analysis showed significant results for male patients between 27-53 years. *Conclusions:* This study shows that positive social support of family was important for the achievement of a recommended physical activity level in the group of male patients. The results of this study are partly in line with the literature and are helping to enlarge the understanding of social support.

Key words: *Behavior, physical activity, physical inactivity, social support, metabolic syndrome*

Introduction

One of the goals of the World health organization (WHO) is to reduce the avoidable burden of the risk of premature mortality from cardiovascular diseases, diabetes, cancer, and chronic respiratory diseases [1]. Some of the risk factors for these diseases clusters together and have been termed the metabolic syndrome [2]. Metabolic risk factors are abdominal obesity, high triglyceride level, low high-density lipoprotein cholesterol level, high blood pressure and high fasting blood sugar. The metabolic syndrome is mostly lifestyle related and lifestyle modification like reduced-energy diet and increased physical activity level is the recommended first intervention for the metabolic syndrome [3].

Despite the known effects of increased physical activity a third of the adult population worldwide does not reach the recommended level of daily physical activity [4]. Physical activity is defined as "any bodily movement produced by skeletal muscles that results in energy expenditure" [5]. The global recommendation for sufficient physical activity is 30 minutes of moderate-intensity aerobic physical activity five times a week or 20 minutes of vigorous-intensity aerobic physical activity three times a week, or equivalent or an equivalent combination achieving 600 metabolic equivalents (MET'S) per week [4].

Further research had shown that international exercise referral schemes increased the number to patients who reached a physical activity level according to the health recommendations [6]. The Swedish national board of health and welfare encourage health care workers like physiotherapists, nurses and physicians to implement physical activity as an integrated method and prescribe PAP to prevent and treat lifestyle related diseases [7]. PAP is a personalized written prescription of physical activity for patients with symptoms or diseases that can be treated with physical activity. This may have either preventive or therapeutic purpose. The prescription can be anything from a simple advice to a comprehensive solution with the support of the health professional [8]. Especially the individual dialog based on the principles of motivational interviewing (MI) may be more effective for the patient to increase physical activity level when prescribing physical activity [9]. A face-to-face-approach with personal counselling, advice and supervision has shown a positive relation to a more active lifestyle [10].

The concept of PAP is based on a variety of theoretical models and theories like the transtheoretical model and the social cognitive theory of Bandura [8]. In 1986 Bandura published *The Social*

Foundations of Thought and Action: A Social Cognitive Theory (SCT) which describes the complex interaction between individual, environment and behavior [11]. The SCT explains health behavior on an individual and interpersonal level. Social relationships and their reciprocal importance for health behavior were described in the theory. Social support is a construct which even finds in other behavior change theories and models and is frequently used to explain physical activity behavior. Different studies and behavior change models show whether people can successfully adopt increased physical activity as a regular lifestyle behavior and how it can be related to their social environment and support [12]. There are however several different definitions of social support [13]. In the context of behavior change it is defined as the supportive or unsupportive resources of family and friends (verbal, emotional, material, skill or labor, time, cognitive, information, feedback) to move towards a goal [14].

A meta-analysis showed that social support might be twice as important for the adherence to physical activity when the individual is following an exercise prescription as if it trained self-motivated [15]. However, it is not definitely clear which factors of social support really correlates to physical activity. Previous studies have shown that social support from a close person increase the likelihood of maintaining recommended levels of physical activity [16, 17]. The positive correlation between social support and physical activity could for example be mediated by gender, social status and ethnic background [18]. It is possible that specific types of social support like friend support or family support have different functions in the work with behavior change [17]. Social support may be more important in some ages than others [19]. There are a few studies who investigated the importance of social support for exercise for the group of women, regarding factors like age or diseases [20, 21].

Identifying subgroups and interpersonal correlates for use in interventions and targeting their effectiveness is important for physical activity interventions [22]. It is the responsibility of the health care professional to distinguish resources when working with individual physical activity behavior changes [22]. Social support for physical activity could be an essential educational point in interventions. Physiotherapists are concerned to identify the needs and resources of the patient sometimes even in the interaction between the patient and their family/peers [23].

The hypothesis is that social support is an important factor in the personal dialog between physiotherapist and patients in the work of behavior change. The primary aim of this study was to describe whether social support was associated with the achievement of recommended physical

activity level in patients with metabolic syndrome who received a PAP. Furthermore, the importance of support from family or friends was also investigated in regard to age and gender.

Material and methods

The data were derived from a larger study” The Gothenburg PAP study” [24]. Between 2010-2014 402 physically inactive patients with at least one component of the metabolic syndrome, 30-80 ages, were recruited at 15 health care centers in Gothenburg center/west. Patients not able to understand the Swedish language were excluded.

The patients were informed about the possibility to receive a PAP in the waiting room or orally by the caregiver. In case of the agreement of the patient to participate in the study, authorized personnel, mainly nurses, at the health care centres prescribed PAP to the patient based on the principles of motivational interviewing (MI) [25]. The participants completed a questionnaire assessing physical activity level, socio-demographic and behavioral factors including perceived social support. The patients were followed-up at six months again filling in the questionnaire.

As seen in Figure 1 the study material was collected at baseline (refers to the time point before receiving a PAP) and at six month follow up (refers to the time point the patients came to the health care center for follow-up).

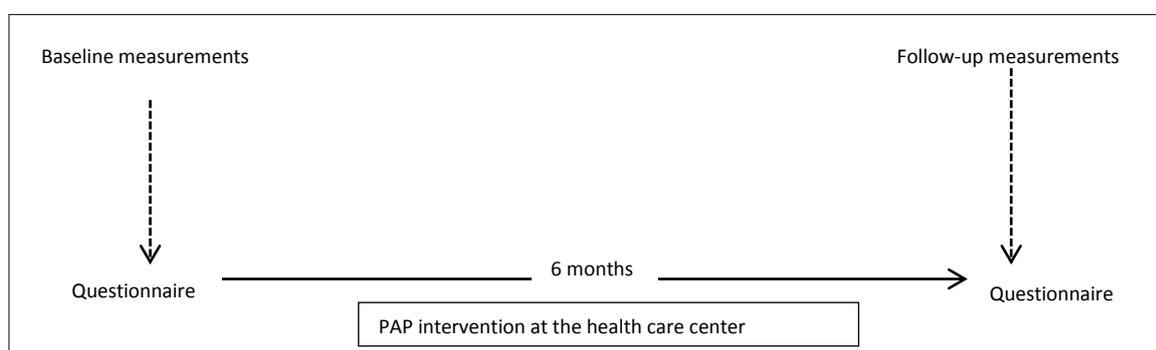


Figure 1. Flow chart for the measurements.

The “Gothenburg PAP study” is approved by the Regional Ethical Review Board in Gothenburg, for the randomized study with diary number 529-09 and for the use of the registry for research with diary number 678-14

Measures

Physical activity level. Physical activity level was measured using; Self-assessment according to the public health recommendation of the American college of Sport's medicine (ACSM) and American Heart Association (AHA) [26]. It is used as a measurement for achieving the recommended level of physical activity. The patient responded to two activity questions (ACSM/AHA questionnaire) based on a scale from the Lifestyle intervention research group (LiR group) of the University of Linköping. The scale was the working document to the current questionnaire to assess and evaluate physical activity in health care by the Swedish national board of health and welfare [27].

The last seven days of activity were investigated, where 30 minutes of moderate-intensity physical activity per day resulted in 1 point and 20 minutes of more vigorous-intensity physical activity per day resulted in 1.7 point during each specific day of the week. At least 5 points needs for achievement of the public health recommendation [26]. The value of 5 points equates to 30 minutes of moderate-intensity aerobic physical activity five times a week like walking or 20 minutes of vigorous-intensity aerobic physical activity three times a week.

Like in the larger study from Lundqvist et al. on which this study is based a value of <5 points indicated an inadequate physical activity level [24]. Patients with ≥ 5 points according to ACSM/AHA's self-reported questionnaire were defined as responders and patients with less than 5 point were defined as non-responders.

Social support. Social support from family and friends was measured on a 5 point Likert scale using Sallis' Social Support for Exercise Scale [14]. Like in the original measurement the scale was divided in a family and friends part.

The measure included 13 items, eleven items were positively worded and two items negatively, which described social interactions that might influence exercise behavior during the previous three month. The positive items reflected interactions like "exercising together, verbal support, planning for exercise and encouragement". The negative items described "rewards and punishment" from family and friends related to exercise like "Complained about the time I spend exercising". Responses ranged from 1 (none) to 5 (very often). Not applicable was given a score of 1.

The social support from family and friends scales used in the current study have acceptable test-retest reliability (r values = 0.77-0.86) and internal consistency (r values =0.61-0.91) [28].

All scales are available in Swedish.

Statistical analyses

The data were analyzed using the program IBM SPSS Statistics 22. Descriptive statistics on the participant's characteristics were presented. To examine associations between social support and the recommended physical activity level a binary multiple logistic regression analysis was used.

Independent variables were social support family/friends at baseline according to Sallis' Social Support for Exercise Scale, controlled by age, gender and economic situation. Dependent variable was physical activity level ≥ 5 according to ACSM/AHA questionnaire after six month of treatment with PAP. For the dependent variable recommended physical activity level the patients were categorized into those patients who achieved the recommended physical activity level (responders) and patients who did not achieved the recommended level (non-responders).

Also Sallis's Social Support for Exercise Scale for social support, due to positive skew, was divided into a binary scale (dichotomized: no social support/ existing social support). The median positive social support value of all participants was used as cut-off; 20.96 points for family and 18.72 points for friends at baseline (11 items- range 11-55 points). No positive social support was defined as < 20 points at baseline and existing positive social support was defined as ≥ 20 points at baseline for family; < 18 as no social support and ≥ 18 point as existing social support for friends. For negative social support the cut-off point equaled to 2 points (< 2 no negative support, ≥ 2 existing negative support) for both family and friends (2 items –range 2-10 points). Separate analyses were conducted for evaluation of associations of 1) positive social support and 2) negative social support to the recommended physical activity level.

In a second step the analysis was performed separately for women and men. To investigate the importance of age the data were split into three age groups based on statistically analysed cut-off points of the tertiles of the age of all included persons: group 1 aged 27-53 years, group 2 aged 54-64 years and group 3 aged over 65 years.

A missing data analysis was performed due to the relative high drop-out rate. All background data were compared for control of higher drop-out in a certain group. Person's Chi-squared test were

executed for control of gender, marital status, education and economic situation. P-value <0.05 was defined as statistically significant.

Results

Descriptive data

The final sample size was 330 patients (56.8% female) who had completed 6 month follow up measures, 72 patients discontinued due to different reasons (18% drop-out). In Table I the participant's characteristics and the related missing data analysis were described. The missing data analysis showed that the drop-out group was comparable with analyzed group apart from gender. There was a significant lower drop-out for male patients.

Table I: Demographic characteristics of the sample, baseline and six-month, drop-out and missing data analysis.

| | Baseline | Six-month | Drop-out | p-value ^a |
|--|------------|------------|-----------|----------------------|
| Variable | N= 402 (%) | N=330 (%) | N=72 (%) | p |
| Physical activity level ≥ 5 | 191 (57.5) | 191 (57.5) | | |
| Mean age, years (age span) | 58 (27-80) | 58 (27-80) | | |
| Sex | | | | 0.026 |
| Male | 174 (43.2) | 154 (46.1) | 20 (27.7) | |
| Female | 229 (56.8) | 180 (55.9) | 49 (68.0) | |
| Marital status | | | | 0.296 |
| Cohabiting (married/living with a partner) | 216 (55.8) | 177 (56.2) | 39 (54.1) | |
| Non-cohabiting (single or living apart) | 153 (39.5) | 122 (38.7) | 31 (43.0) | |
| Others | 18 (4.7) | 16 (5.1) | 2 (2.7) | |
| Education | | | | 0.170 |
| Lower level | | | | |
| (Completed 9-year compulsory education) | 78 (19.9) | 61 (19.0) | 17 (23.6) | |
| Gymnasium (high school) | 142 (36.3) | 108 (33.6) | 34 (47.2) | |
| Higher level | | | | |
| (College or university education) | 166 (42.5) | 150 (44.9) | 16 (22.2) | |
| Others | 5 (1.3) | 2 (0.6) | 3 (4.1) | |
| Subjective personal financial situation | | | | 0.125 |
| Poor | 43 (11.1) | 40 (12.6) | 3 (4.1) | |
| Good | 231 (59.4) | 196 (61.0) | 35 (48.6) | |
| neither poor or good | 115 (29.6) | 85 (26.5) | 30 (41.6) | |

a: P-values from Chi squared test for control of higher drop-out in a certain group

Regressionsanalysis of the whole sample

As seen in Table II there were no significant association between positive or negative social support of friends or family at baseline and the achievement of a recommended physical activity level after six months in the total sample of patients with at least one component of the metabolic syndrome who received PAP, controlled for age, gender, marital status, education and economic situation. A subgroup analysis were required to analyze associations between specific types of support (family/friend support) regarding to gender and age.

Table II: Odds ratios and 95% confidence intervals from logistic regression analyses between social support and recommended physical activity level, controlled by age, gender, marital status, education and economic situation.

| | "Responders" (n=191) | | |
|--------------------|-----------------------|-----------|---------|
| | OR | 95% CI | p-value |
| Family support | | | |
| Positive | 1.59 | 0.94-2.67 | 0.080 |
| Negative | 0.67 | 0.30-1.48 | 0.326 |
| Friends support | | | |
| Positive | 1.07 | 0.63-1.80 | 0.799 |
| Negative | 1.41 | 0.61-3.24 | 0.420 |
| Age | 0.99 | 0.97-1.01 | 0.730 |
| Sex | 0.63 | 0.40-1.02 | 0.061 |
| Marital status | 0.79 | 0.52-1.20 | 0.278 |
| Education | 0.98 | 0.73-1.32 | 0.929 |
| Economic situation | 1.03 | 0.79-1.33 | 0.804 |

Statistical significance was set at $p \leq 0.05$; CI, confidence interval; OR, odds ratio

Sub-group analysis family support

While family support did not show any significant results in the analysis of the whole sample the sub-group analysis for the separate sexes showed statistical significant results of positive social support. As seen in Table III males between 27-80 years (all ages) had statistically significantly higher odds to achieve the recommended level of physical activity with family support. Further splitting of the data showed that especially males between 27-53 years (group 1) had 11.03 higher odds to achieve the recommended level of physical activity with the positive support of family. None of this was seen among the females.

Table III: Odds of association between family support and achieved recommended physical activity level

| | <u>Men / all ages</u> | | | | <u>Women / all ages</u> | | | |
|---------------------|-----------------------|--------------|-------------------|--------------|-------------------------|------|-----------|---------|
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 96 | 2.09 | 1.00-4.39 | 0.050 | 95 | 1.24 | 0.65-2.37 | 0.503 |
| | <u>Men /group 1</u> | | | | <u>Women/ group 1</u> | | | |
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 45 | 11.03 | 2.13-56.96 | 0.004 | 26 | 1.13 | 0.29-4.34 | 0.856 |
| | <u>Men /group 2</u> | | | | <u>Women /group 2</u> | | | |
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 33 | 0.74 | 0.22-2.42 | 0.622 | 29 | 1.24 | 0.41-3.72 | 0.690 |
| | <u>Men /group 3</u> | | | | <u>Women /group 3</u> | | | |
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 18 | 0.95 | 0.16-5.41 | 0.959 | 40 | 0.93 | 0.31-2.79 | 0.903 |

Sub-group analysis friends support

Results of the subgroup analysis of positive social support for physical activity from friends are illustrated in Table IV. Even here the association between social support and the recommended physical activity level were not significant for the whole group nor in the analysis of just age or sex. There were neither statistically significant results in the sub-group analysis. A tendency was seen that social support from friends was associated with the achievement of a recommended physical activity level for men over 65 years (group 3).

Table IV: Odds of association between friends support and achieved recommended physical activity level

| | <u>Men / all ages</u> | | | | <u>Women / all ages</u> | | | |
|---------------------|-----------------------|-------------|-------------------|--------------|-------------------------|------|-----------|---------|
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 96 | 1.35 | 0.65-2.81 | 0.415 | 95 | 1.05 | 0.55-2.02 | 0.869 |
| | <u>Men/ group 1</u> | | | | <u>Women/ group 1</u> | | | |
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 45 | 0.39 | 0.08-1.81 | 0.231 | 26 | 1.75 | 0.43-7.06 | 0.426 |
| | <u>Men/ group 2</u> | | | | <u>Women / group 2</u> | | | |
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 33 | 2.31 | 0.71-7.52 | 0.164 | 29 | 0.40 | 0.13-1.21 | 0.108 |
| | <u>Men / group 3</u> | | | | <u>Women / group 3</u> | | | |
| | <i>n</i> | OR | 95% CI | p-value | <i>n</i> | OR | 95% CI | p-value |
| “Responders” | 18 | 4.48 | 0.89-22.51 | 0.068 | 40 | 1.96 | 0.66-5.83 | 0.222 |

Sub-group analysis negative support of family/friends

In the analyses of negative support there were no statistically significant results for the associations of negative social support of family or friends and achievement of recommended physical activity. Not on the group as a whole nor on the subgroup analyses conducted gender or age.

Discussion

Result discussion

In summary, this paper indicates that positive social support of family may be an important predictor for the achievement of a recommended physical activity level for male patients with at least one component of the metabolic syndrome. Positive social support of family seems to be especially important for male patients between 27-53 years. There is a tendency that positive social support of friends is important for males between 65-80 years.

It should be noted that there was no statistically significant result before splitting the data into subgroups. The overall conclusion that social support has a positive influence on physical activity behavior [15] could not be confirmed. In this paper social support of family or friends seems not to increase the possibility to achieve the recommended physical activity level for the whole sample of patients with at least one component of the metabolic syndrome. However, the subgroup analysis of social support was necessary to 1) identify the importance of positive social support for different ages and gender and 2) identify different types of positive social support in regard to these.

Like mentioned in the introduction there is more consistent literature about associations between social support and physical activity for women [20, 21]. The missing findings for women in this study could be a type 2 error, due to a small subgroup. For example a similar study with a larger study population of young healthy adults with a varied ethnic background indicated the importance of family and friends support for white women [18]. The results for men coincided well with the findings of this study while even women's overall activity was statistically significant positively related to support of family and friends. The study had a sample of 466 young adults (260 females, mean age 38.5) to investigate while this study included 71 "younger" adults (27-53 years old, 26 females). Aside from small subgroup, can even cultural differences and the differences between patientgroups and healthy or sick individuals explain the distinctions between the results of this study and other studies for females. Women have different roles and preconditions for physical activity in the society. For example could the importance of social support for younger women (<40 years) not be confirmed of a study from Taiwan which examined the effect of social support on exercise for breast cancer survivors [20]. The study showed that younger women were more confident about their exercise behavior without social support while women over 40 years old named social support as an important facilitator of exercise behavior. Another study about women investigated the association between women's social support from family and friends with physical activity levels in a group of patients with gestational diabetes mellitus [21] and concluded that social support of both family and friends were positively associated to increased physical activity. However, this result can be influenced by factors like overweight, the role of pregnancy and a low self-efficacy, which also can explain deviation to the results for women of this paper.

Interesting in regard to other research are the results for older adults in this paper. The results of this study showed a tendency that social support of friends may increase the possibility to achieve a recommended physical activity level. There was no statistically significant result. The sub-group analysis included 18 male individuals. However, the tendency that social support of friends may be

important for older people matches with results of earlier studies [29, 30]. Resnick et al. analyzed the differences between family and friends support [30], and showed for a sample of 74 older adults (over 65 years) that friend support had a direct statistically significant influence on self-efficacy expectations related to exercise. Family support had no statically significant correlation to exercise behavior in this group. An explanation can be that physical activity behavior may be learned of imitation. The role model function of parents and maybe later the partner can be important in younger ages while older may not imitate anymore but rather find other people who have same interests (friends). Noteworthy is, however, that the majority of the participants in Resnick et al. were female (85%) and unmarried (81%). In summary, the knowledge about the importance of friends support for older people may be enlarged, unclear remains if especially males need more friends support.

In relation to the findings of this study and the partly inconsistency to other studies it is not possible to draw any definitive conclusions based on the findings. The interpretation of evidence for social support has three challenges 1) a large heterogeneity of the methods and methods for the measurement, 2) a lot of different types and sources of social support for specific subgroups (age, gender) and 3) the most studies use cross-sectional designs. All findings are based on statistical associations between factors so called correlates research [22]. There is almost no evidence of a causal relationship between factors and physical activity. To deal with this challenges methods and measurement of physical activity and social support needs to be more comparable. The variety of results reinforces the need to expand studies analyzing different types and sources of social support for specific groups and may be a systematic review of all existing research to sort and clarify aspects of social support for physical activity. Knowledge about correlating and causal factors of behavior change needs to be enlarged.

Even in this study just the correlating effect of social support to a recommended physical activity level was investigated. Considering correlating effects, there are of course also other variables of interest which also can influence the physical activity level. As named in the study from Kim et al. [21] and Resnick et al. [30] self-efficacy might have a the most important role for increased physical activity. Resnick et al. found just an indirect effect of social support to exercise behavior through increased self-efficacy. Self-efficacy is highly correlated with increased physical activity and may be the main factor for a physical activity intervention [22]. Social support may not have a direct effect on physical activity but instead on exercise self-efficacy.

The SCT provides a useful framework for understanding the motivation to get physically active. The personal aspects are important to understand in the work of motivation and behavior change. Physiotherapists cannot change environmental or structural factors but they can affect some personal factors like self-efficacy and social support. This study enlarges the understanding of an important framework for physiotherapists and all other all personal working PAP. The reviewed literature showed that there are still no consistent findings for the patientgroups between 30-65 years old. In this study we see a tendency that social support is important for men. This finding can be confirmed of all reviewed studies which included men [15, 16, 18, 31]. To our knowledge no previous studies had investigated associations of family support for physical activity especially for men. There were no investigations done for the difference of social support for women or men. The finding of this study might enlarge the knowledge about the value of family support for men. Furthermore it is interesting that the age group 27-53 years had a high association between social support of family and the achievement of a recommended physical activity level. Even here no previous research was found. Providing social support can be a significant part in the work of behavior change and may help younger men to get more active.

Method discussion

A number of limitations must be acknowledged. Like mentioned this study is a cross-sectional study, therefor no causality between social support and the recommended physical activity level can be attributed. The self-reporting measurement using self-assessment according to ACSM/AHA's public health recommendation for measurement of physical activity is a weakness in this study. The used instrument has not been adequately evaluated for validity and reliability. Measurement of physical activity shows a wide variety between previous studies and is common bias [32]. Certainly the measurement of physical activity during self-reported time and frequency according to recommendations is the common way in studies who investigate associations between social support and physical activity level [17, 21]. Using self-reporting of physical activity is motivated to avoid a usual method bias of questionnaires which are asking about degree of effort which can be influenced by the individual's physical capacity. This indicates that an individual with better fitness and strength estimates a higher level of physical activity [33]. Also the body weight could be a limitation factor. The reason for using a self-assessment according to ACSM/AHA's public health recommendation was to measure the physical activity level of an individual level through a questionnaire without missing time and frequency according to the public health recommendation. The chosen instrument quantifies the level of activity in relation to the recommendation which was appropriate to the purpose of the study.

Sallis social support for exercise habits scale has demonstrated adequate internal consistency and 1- to 2-week test-retest reliability with young Caucasian women [14]. Criterion validity and reliability were confirmed in other studies [15, 18]. A weak point in the scale seems to be the negative items “rewards and punishment”. In Sallis report the negative items of family support are not highly correlated to exercise [14]. In another study the negative items were dropped to avoid method bias [16]. Considering negative support as a potential source of bias the results of the negative data has to been interpreted with caution, especially the family part.

Conclusion

Social support can come from varied sources and influence different groups of age and gender. This study shows higher odds for men to get physically active with help of their family. These results can partly be confirmed of the existing literature. However there are still numerous unexplored issues and unexplained findings. All knowledge in this area helps to get better in finding resources in the work with behavior change to get physically active. This study helps to enlarge the understanding of the framework SCT with a deeper analysis of the factor social support.

Conflict of interest

None declared.

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