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# Cross-cultural validation of a simple self-report instrument of physical activity in immigrants from the Middle East and native Swedes

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## Abstract

**Aim:** To investigate cross-cultural validity of a simple self-report instrument of physical activity intended to be used in Swedish health care. **Methods:** A validation study performed in 599 Iraqis (58% men) and 553 Swedes (53% men) aged 30-75 years living in the city of Malmö, Sweden. The self-report instrument by the Swedish National Board of Health and Welfare was compared to corresponding measures assessed from accelerometry as reference. **Results:** The agreement between the methods in assessing the participants as sufficiently/insufficiently physically active (cut-point 150 $min \cdot week^{-1}$) was 65% in the Iraqis and 52% in the Swedes ($p<0.001$). The proportion disagreement where the self-reported physical activity was sufficient but insufficient according to the accelerometry was 26% and 45% in Iraqis and Swedes, respectively. The physical activity time ($min \cdot week^{-1}$) was overestimated by self-report compared to accelerometry by 71% in the Iraqis and 115% in the Swedes ($p<0.001$). The smallest and largest overestimation was seen in Iraqi (57%) and Swedish (139%) women, respectively. The deviation of the self-report instrument compared to accelerometry was related to the physical activity level, as the overestimation mainly occurred at lower physical activity. **Conclusions:** The self-report instrument proposed by the Swedish National Board of Health and Welfare may overestimate the proportion sufficiently physically active, but to an extent depending on cultural background and gender.

**Key words:** migration, ethnicity, gender, accelerometer, GT1M, agreement, accuracy.

## Introduction

The Middle East is one of the regions in the world with the highest prevalence of type 2 diabetes (T2D) [1]. The reduction in new cases of T2D is estimated to be larger here compared to other regions in the world if the population achieved sufficient physical activity [2]. Immigrants from the Middle East form a significant cultural minority group in Sweden. They show higher risk of T2D and are less physically active compared to native Swedes [3-5]. The Migration and Ethnicity on Diabetes In Malmö (MEDIM) study targets T2D and lifestyle behaviors in Swedish residents born in Iraq.

The self-report instrument of physical activity in the MEDIM study consists of two questions assessing moderate and vigorous physical activity. It was proposed by the Swedish National Board of Health and Welfare with the intention to identify patients with insufficient physical activity and to follow-up provided health care interventions [6]. Self-report instruments show large variation in their ability to assess physical activity [7]. It is therefore important to investigate the validity of an instrument intended to be implemented in large scale using appropriate reference methods. If the self-report instrument is used in groups of different cultural backgrounds, its cross-cultural validity needs to be determined as well [8]. The reference method should have higher precision than the method to be tested and high comparability with golden standards [9]. Technical developments allow large-scale studies to use accelerometers for objective measures. Accelerometers show high comparability with golden standards (i.e. indirect calorimetry or doubly labeled water) [10], and as objective methods they do not share the bias attributed to subjective methods [7]. Our aim was to investigate the validity of the self-report physical activity instrument proposed by the Swedish National Board of Health and Welfare in Iraqi immigrants and native Swedes with accelerometry as reference method.

## Methods

### Participants

Malmö is a multicultural city with approximately 300000 residents with 9000 having their origin from Iraq. Of those aged 30 to 75 years, over 4000 were born in Iraq. Residents born in Iraq (N=1647) and native Swedes (N=2293) aged 30 to 75 years were randomly selected from the census register and invited by phone and mail. After excluding those with serious physical and mental illness, 1627 Iraqis (61% men) and 2285 Swedes (52% men) were eligible:

- *Agreed to participate:* Iraq 1013 (1013/1627=0.62; 58% men) and Sweden 875 (875/2285=0.38; 51% men).
- *Physical examination, blood sampling, questionnaire:* Iraq 802 (802/1627=0.49; 58% men) and Sweden 678 (678/2285=0.30; 49% men).
- *Accepted to wear and returned activity monitor (response rate)*: Iraq 779 (779/1627=0.48; 58% men) and Sweden 654 (654/2285=0.29; 53% men); 10 activity monitors were lost in total 1433 (779+654) administrations.
- *Valid data extracted from accelerometers:* Iraq 618 (618/1627=0.38; 57% men) and Sweden 556 (556/2285=0.24; 53% men).
- *Complete study data:* Iraq 599 (599/1627=0.37; 59% men) and Sweden 553 (553/2285=0.24; 55% men).

The Ethics committee at Lund University approved the study (No. 2009/36 & 2010/561) and written informed consent was given by all participants.

**Procedures**

Trained research nurses conducted and supported all procedures, including physical examinations, oral glucose tolerance tests, blood samplings, study questionnaire, accelerometer administration and instructions. During the visit at the research laboratory the participants performed the study questionnaire in Swedish or Arabic. The latter was translated and back-translated by two independent authorised translators with Arabic as a native language. Participants were provided an accelerometer with elastic belt together with oral and written instructions, a simple diary for reporting wearing of the accelerometer, and a prepaid padded envelope for return. Oral and written instructions and support during the visit were provided in Swedish or Arabic. Data were collected from February 2011 to July 2012.

**Physical activity**

*Self-report*

The self-report instrument asks about *physical training* making one breath hard (presenting examples such as running, aerobics and soccer) during a usual week and provides five answer alternatives: **1)** 0 minutes; **2)** <30 minutes; **3)** 30-60 minutes; **4)** 60-120 minutes; and **5)** >120 minutes per week [6]. It also asks about *daily exercise* with a duration of at least 10 minutes (presenting examples such as walking, bicycling and gardening) during a usual week providing seven answer alternatives: **1)** 0 minutes; **2)** <30 minutes; **3)** 30-60 minutes; **4)** 60-120 minutes; **5)** 120-180 minutes; **6)** 180-300 minutes; and **7)** >300 minutes per week. The mean value for the answer alternative was used, except for the lowest and highest category. For the highest category, the lowest value was used, i.e. 120 and 300 minutes, respectively. Weekly physical activity time ($min \cdot week^{-1}$) was calculated as the sum of daily exercise (representing moderate physical activity) weighted by 1 and physical training (representing vigorous physical activity) weighted by 2. These weights are in line with how the two intensity levels are weighted in the physical activity recommendation by the World Health

Organization, i.e. 150 minutes of moderate physical activity versus 75 minutes of vigorous physical activity [11], and are proposed by the Swedish National Board of Health and Welfare [6]. The two questions with answers were translated and back-translated by two independent authorised translators with Arabic as a native language.

*Accelerometry*

ActiGraph GT1M and ActiLife data analysis software (ActiGraph™, Pensacola, FL, USA) were used for objective physical activity. The GT1M model is a small (4.0 × 3.9 × 1.8 cm), non-obstructive light (26.7 g) unit worn on an elastic belt round the waist. It registers movement intensity with a primary output called “counts”, which shows a linear increase with increasing physical activity intensity across a broad range of intensities [12]. GT1M has high inter-monitor reliability [13]. Study participants were instructed to wear the GT1M on the left hip for 7 consecutive days from the day after the visit to the research laboratory, except during sleep, showering and swimming. The epoch length was set to 1 minute. The definition of a non-wear period was set to ≥60 minutes of consecutive zero counts, which has shown high validity [14]. Ten hours was determined to be adequate wearing for a valid day [15]. We included participants with at least three valid days with one of those days being a weekend day. This was a compromise between inclusion of sufficient number of days and to preserve the representativeness of the sample [16]. To get weekly amount of moderate and vigorous physical activity, the mean daily value was multiplied by 7. Freedson´s cut-points for moderate (1952-5724 counts$\cdot$min$^{-1}$) and vigorous (≥5725 counts$\cdot$min$^{-1}$) were used [17]. Weekly physical activity time (min$\cdot$week$^{-1}$) was calculated as the sum of moderate physical activity with duration of at least 10 minutes weighted by 1 and all vigorous physical activity weighted by 2, for direct comparison with the self-report outcome.

## Participant characteristics

*Body mass index*

Body height was measured to the nearest cm and body weight to the nearest kg with participants wearing light clothes and without shoes. Body mass index (BMI) was calculated as weight (kg) / height (m)$^2$.

*Sociodemographics*

In the present study we included age, sex, educational level and financial situation from the study questionnaire. The participants had to choose between four categories of educational level: 1) no education; 2) elementary school, high school; 3) college; 4) university. For the statistical analyses, category 1 and 2 were merged creating three categories. Financial situation was assessed from the question of whether the participant has had constraints the latest 12 months meeting payments of the rent, food and other expenses. There were three categories to choose between: 1) yes, at several occasions; 2) yes, at one occasion; and 3) no. Category 1 and 2 were merged creating two categories included in the statistical analyses.

## Statistics

Comparisons between Iraqis and Swedes were performed using an independent samples t-test for continuous variables and a chi-square test for categorical variables. Three statistical approaches were used to investigate the validity of the self-report instrument with accelerometry as reference:

- Proportion of agreement between methods in classifying participants as sufficiently (≥150 min·week$^{-1}$) or insufficiently physically active; this statistical approach was included as the intention of the self-report instrument is to assess whether sufficient physical activity is reached [6].

- Comparability of physical activity time (min·week$^{-1}$) between methods using paired t-test.
- Bland-Altman Plot for graphical display of agreement between methods for physical activity time (min·week$^{-1}$) across the range of the physical activity level [18]; in this study we put the accelerometer data to represent the sample range of “true” physical activity.

Statistical analyses were performed with IMB SPSS Statistics version 20.0 (IMB Corporation, Armonk, NY, USA).

## Results

The Iraqis were somewhat younger, had lower educational level, had more often financial constraints and had higher BMI compared to the Swedes (Table 1). The mean (sd) number of days wearing the accelerometer was 6.1 (1.1) in the Iraqis and 6.5 in the Swedes, with mean (sd) wear time of 857 (103) and 888 (91) min·d$^{-1}$, respectively. The Iraqis showed less proportion sufficiently physically active and less physical activity time compared to the Swedes. The differences were larger with self-report compared to accelerometry. According to the self-report instrument, 34% of the Iraqis and 70% of the Swedes were sufficiently physically active (34%/70%=0.49). The corresponding proportion according to the acceleromtry was 17% and 27%, respectively (17%/27%=0.63).

In categorizing participants as sufficiently/insufficiently physically active, there was a higher proportion agreement between self-report and accelerometry in the Iraqis compared to the Swedes, 65% versus 52% ($p<0.001$; Table 2). The proportion of disagreement where the participants were sufficiently physically active according to the self-report instrument but insufficiently physically active according to the accelerometry was lower in the Iraqis, indicating less overestimation by self-report in this group than in the Swedes.

Physical activity time was overestimated by self-report compared to accelerometry, and this disagreement was influenced by both cultural background and gender (Table 3). The overestimation was less in the Iraqis than in the Swedes (diff. 74 (44%) min·week$^{-1}$, $p<0.001$), although the difference in the overestimation because of cultural background was more pronounced in the women (diff. 97 (82%) min·week$^{-1}$, $p<0.001$) than in the men (diff. 61 (18%) min·week$^{-1}$, $p<0.001$). As a consequence, the largest contrast between methods in assessing difference in physical activity time because of cultural background occurred in the women.

Displaying the deviation of the self-report instrument compared to accelerometry in assessing physical activity time (y-axis) against the level of physical activity assessed from accelerometry (x-axis) revealed that at any physical activity level there was a large variation in the deviation of self-reported physical activity, as well as that there was a negative relationship between the deviation and the physical activity level (Figure 1). The overestimation mainly occurred at lower physical activity levels.

## Discussion

Key findings in the present study were that the self-report instrument overestimated physical activity compared to accelerometry but to a less extent in Iraqis than in Swedes, especially in Iraqi women. The overestimation appeared at lower levels of physical activity.

There is a general tendency of overestimation by self-report, although the error varies between instruments. The overestimation by self-report compared to accelerometry is 44% with a range of -78% to 500% [7]. In the light of these data, the self-report instrument by the Swedish National Board of Health and Welfare may perform with an accuracy that would be expected from self-report instruments, i.e. at a low-to-moderate level. However, it is intended to provide a crude measure of whether a patient is sufficiently physically active, not to provide data at the accuracy level of minutes spent physically active or to be used in research *per se* [6]. Yet, our data showed that we may fail to identify a significant proportion of those patients who really are insufficiently physically active, as the self-report instrument showed overestimation compared to accelerometry at lower levels of physical activity.

Another problem may be encountered when using the self-report instrument in patients varying in age, gender, socioeconomics and cultural background. Our data showed less overestimation in the Iraqis than in the Swedes, especially among the Iraqi women. This may result in that the treatment inserted may vary not only because of the need of the patient but also whether the patient is native Swede or from the Middle East, man or a woman etc. In turn, this may affect regional/national evaluations of health care provided.

There are several potential explanations to the estimation deviations of the self-report instrument from the accelerometry. *First*, the format of the two questions included may have resulted in overlapping reporting of activities in both Iraqis and Swedes. The concept "daily exercise" may not exclude "physical training" despite that distinct examples are provided. A suggestion may be to inform the respondents that the questions are exclusive. *Second*, the concepts included in the questions may have different meanings for Iraqis compared to Swedes, or the types of activities provided as examples may not be as representative of the daily physical activity in the Iraqis as in the Swedes. This may result in absence of reporting and consequently less overestimation in Iraqis, especially in Iraqi women who are less accustomed to exercise and the exercise culture in the Western world or who may spend more time doing activities not captured by the self-report instrument, e.g. home-caring activities that may well reach moderate intensity level [19, 20]. The “daily exercise” question does not capture these types of activities. On the contrary, Swedes are accustomed to a tradition of exercise and an exercise promoting culture with support from governmental and non-governmental organizations, and Swedish men and women may be more equal in financial contribution to and taking care of the home [19]. Cultural adaption of concepts and examples and with wordings increasing the understanding are suggestions reducing the differential bias of the self-report instrument [8]. In the present study, the self-report instrument was translated and back-translated by two independent authorised translators and the participants received instructions and support for clarifications, although the questions with examples were kept in their original forms. This may have improved the applicability of the self-report instrument in Iraqis to a certain degree.

The two physical activity questions normally occur together with questions targeting other lifestyle behaviors (tobacco, alcohol, diet) and the Swedish National Board of Health and Welfare chose to use “usual week” as the reference period for physical activity to make the questions for all lifestyle behaviors uniform [6]. A *third* explanation to the results in the present study may be that it has been argued that the use of “usual week” may increase the risk of overestimation compared to the use of “last 7 days”. However, this is not fully supported in the literature [21, 22]. One reason may be that people tend to conceive usual week as the last 7 days [22]. Therefore, the superiority of using “last 7 days” instead of “usual week” need to be confirmed before we can draw conclusions of its importance for the results herein. Actually, there may have been an advantage of using “usual week” in the present study, as the questionnaire was administrated the day before the start of accelerometry measurement.

Social desirability may be a *forth* explanation to the deviation by the self-report instrument [23]. The participants in the present study at lower physical activity levels tended to overestimate their physical activity, while this was not seen among those at higher physical activity levels. Further, social desirability related to reporting of health behaviors may vary between ethnical groups [24], depending on factors such as knowledge, awareness and experience/custom of physical activity/exercise and its importance to health. For example, native Swedish women may be more accustomed to exercise, more aware of its importance to health and may show higher social desirability of being physical active and fit, while this tendency may be less pronounced in Iraqi women [19]. Social desirability may be difficult to target in simple self-report instruments but attempts should be made when possible to raise this issue with the respondent/patient.

*Finally*, the estimation deviation of self-report instrument from the accelerometry may also be explained by limitations attributed to the later in capturing physical activities [12, 25]. For example, cycling is a common form of commuting in Sweden, which may be captured by the self-report instrument but not by accelerometry. A recent survey in the southern region of Sweden showed that the proportion of cycling commuting in the large cities (including Malmö) was 23% [26]. Cycling has been associated with ethnicity [27], and it is possible that the Iraqi immigrants have not adapted to this form of commuting. Therefore, higher degree of cycling commuting in the Swedes may contribute to a larger difference between the self-report instrument and acceleromtry in this group. Further, the choice of accelerometer cut-points for moderate and vigorous physical activity may have contributed to the overall differences between the methods. The literature offers numerous options, with both higher and lower values compared to the cut-points used herein [28]. The difference between the self-report instrument and accelerometry would have been smaller if lower cut-points had been selected (increasing accelerometer MVPA), and larger with higher cut-points (decreasing accelerometer MVPA). Freedson´s cut-points were selected as they are commonly used in physical activity research. Despite its limitations, accelerometry was employed as reference in the present study as it represents a higher level of precision and accuracy in relation to golden standards than self-report [7, 10].

The low response rate is a limitation of the present study which may have introduced selection bias, although the magnitude is the same as in other comparable studies. There were only minor changes in gender distribution across the attrition steps in both groups. A strength of the study is that it is the first time the cross-cultural validity of the self-report instrument for physical activity proposed by the Swedish National Board of Health and Welfare is investigated using accelerometry as reference. Furthermore, our findings are based on a large homogenous sample of immigrants born in Iraq, together with a well-defined control group which represents a random sample of Swedes in Malmö. Finally, many previous studies have focused only on men while this study focused on both genders.

## Conclusions

The self-report instrument proposed by the Swedish National Board of Health and Welfare may overestimate the proportion of individuals sufficiently physically active. The extent of the overestimation may depend on cultural background and gender. Our study suggests that this self-reported instrument may provide misleading information to health care providers who are intended to use it. Therefore the measurement properties need to be improved for assessments of physical activity in populations with different cultural backgrounds.

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## Conflicts of interests

None declared.

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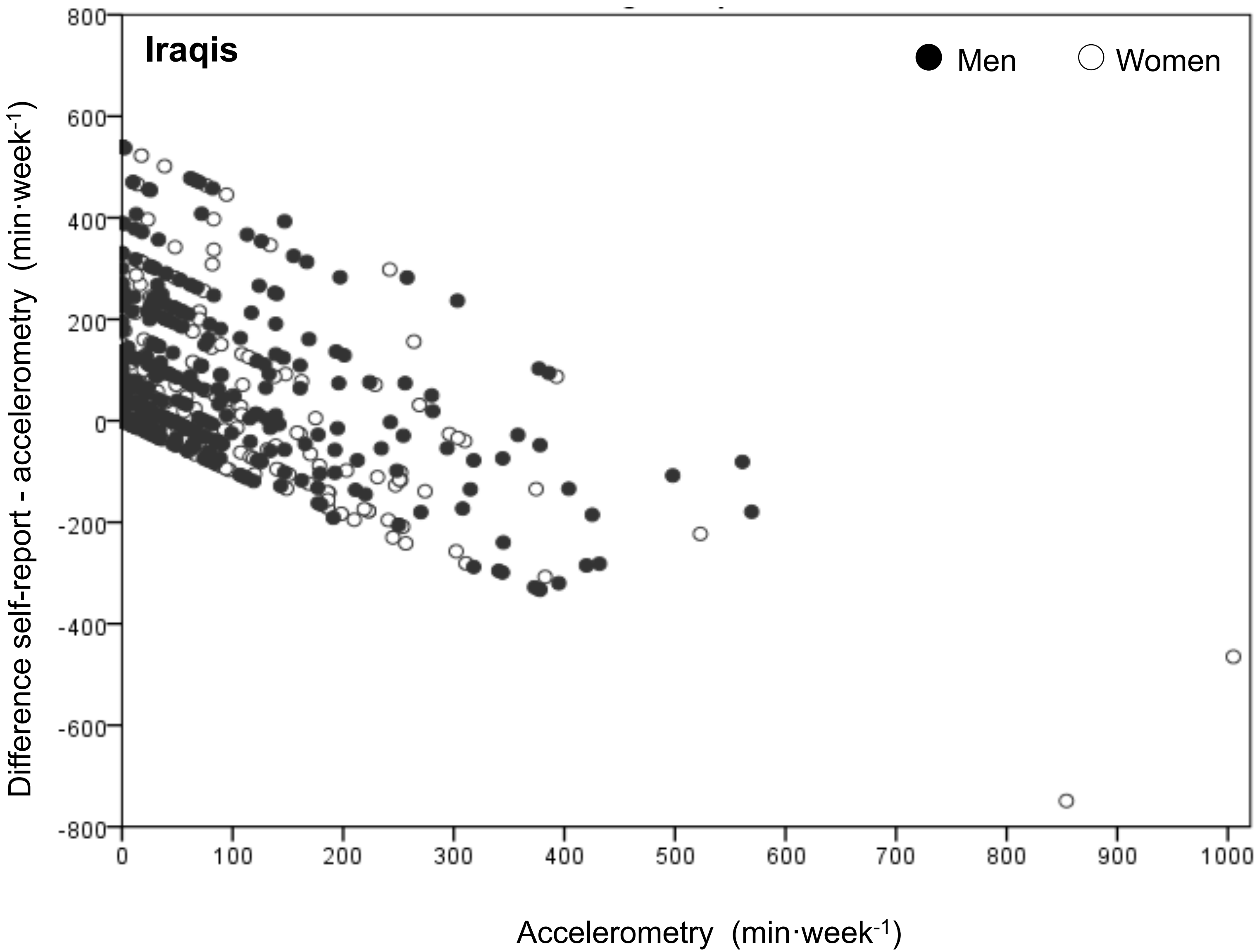
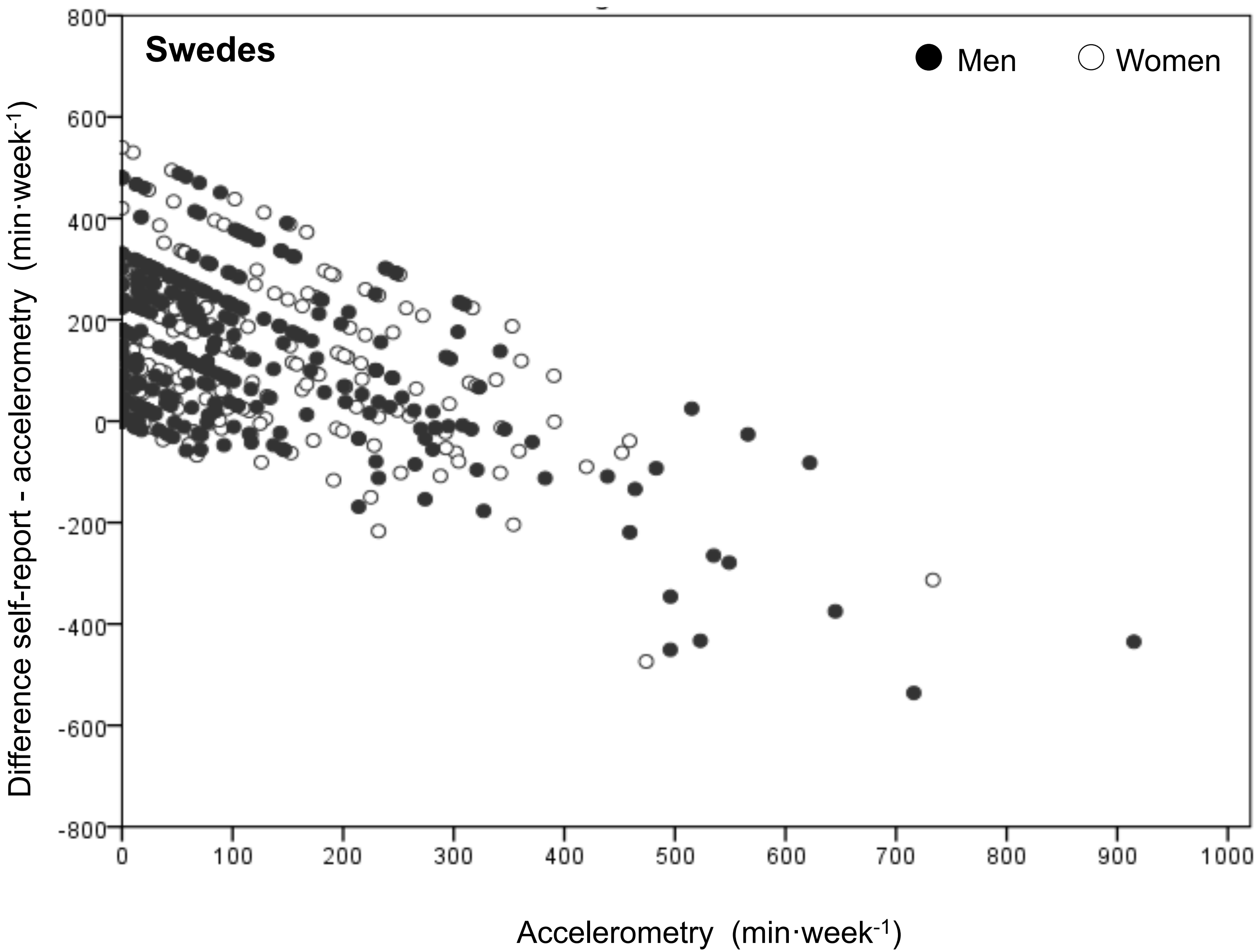
## Figure capture

Plot of the deviation of the self-report instrument from accelerometry against the level of physical activity assessed from accelerometry in Iraqis (N=599) and in Swedes (N=553).

**Figure 1:** Plot of the error in the self-report instrument against the level of physical activity by accelerometry in Iraqis (N=599) and in Swedes (N=553).





Swedes
Men
Women
Difference self-report - accelerometry (min·week-1)
Accelerometry (min·week-1)
800
600
400
200
0
-200
-400
-600
-800
0
100
200
300
400
500
600
700
800
900
1000

**Table 1.** Participants characteristics.

| Variable | | Iraq N=599 | Sweden N=553 | p-value |
|---|---|---|---|---|
| Age (years) | Mean (sd) | 46 (9) | 49 (11) | <0.001 |
| Sex, n (%) | Men | 347 (58) | 291 (53) | 0.07 |
| | Women | 252 (42) | 262 (47) | |
| Educational level, N (%) | No education/elementary school only | 160 (27) | 94 (17) | <0.001 |
| | College | 175 (29) | 242 (44) | |
| | University | 264 (44) | 217 (39) | |
| Financial constraints, N (%) | No | 292 (49) | 478 (86) | <0.001 |
| | Yes | 307 (51) | 75 (14) | |
| BMI ($kg \cdot m^{-2}$) | Mean (sd) | 29.2 (4.6) | 27.1 (4.5) | <0.001 |
| Sufficiently physically active, N (%) | | | | |
| -Self-report | No | 395 (66) | 166 (30) | <0.001 |
| | Yes | 204 (34) | 387 (70) | |
| -Accelerometry | No | 497 (83) | 404 (73) | <0.001 |
| | Yes | 102 (17) | 149 (27) | |
| Physical activity time, $min \cdot week^{-1}$ | | | | |
| -Self-report | Mean (sd) | 139 (143) | 241 (145) | <0.001 |
| -Accelerometry | Mean (sd) | 81 (112) | 109 (129) | <0.001 |

Sufficiently physically active was defined as $\geq 150\ min \cdot week^{-1}$.
Comparison between Iraqis and Swedes was performed using an independent samples t-test for continuous variables and a chi-square test for categorical variables.

**Table 2.** Agreement between self-report (SR) and accelerometry (AC) in classifying participants as sufficiently ($\geq$150 min·week$^{-1}$) or insufficiently (<150 min·week$^{-1}$) physically active.

| | | Agreement, % | | | Disagreement, % | | |
|---|---|---|---|---|---|---|---|
| | N | Sufficient SR/ Sufficient AC | Insufficient SR/ Insufficient AC | Total | Insufficient SR/ Sufficient AC | Sufficient SR/ Insufficient AC | Total |
| **Iraq** | | | | | | | |
| Total | 599 | 8 | 57 | **65**[a] | 9 | 26 | **35**[a] |
| Men | 347 | 10 | 56 | **66**[b] | 7 | 27 | **34**[b] |
| Women | 252 | 6 | 58 | **64**[c] | 12 | 24 | **36**[c] |
| **Sweden** | | | | | | | |
| Total | 553 | 25 | 28 | **52**[a] | 2 | 45 | **48**[a] |
| Men | 291 | 24 | 27 | **51**[b] | 2 | 47 | **49**[b] |
| Women | 262 | 26 | 29 | **55**[c] | 2 | 43 | **45**[c] |

Similar letters indicate distributions compared between Iraqis and Swedes using a chi-square test: **a)** p>0.001; **b)** p=0.007; **c)** p=0.007.

**Table 3.** Comparison of physical activity time from self-report instrument and from accelerometry.

| | N | Self-reported PA | Accelerometer PA | Self-reported PA – Accelerometer PA | |
|---|---|---|---|---|---|
| | | Minutes·week$^{-1}$ Mean (sd) | Minutes·week$^{-1}$ Mean (sd) | Minutes·week$^{-1}$ Mean (sd) *p-value* | Percent Mean (sd) |
| ***Method difference*** | | | | | |
| **Iraq** | | | | | |
| Total | 599 | 139 (143) | 81 (112) | 58 (159)[a] *<0.001* | 71 (197) |
| Men | 347 | 143 (142) | 79 (106) | 64 (151)[b] *<0.001* | 81 (191) |
| Women | 252 | 128 (137) | 84 (119) | 44 (165)[c] *<0.001* | 57 (204) |
| **Sweden** | | | | | |
| Total | 553 | 241 (145) | 109 (129) | 132 (157)[a] *<0.001* | 115 (140) |
| Men | 291 | 240 (143) | 115 (140) | 125 (165)[b] *<0.001* | 99 (138) |
| Women | 262 | 243 (147) | 102 (116) | 141 (149)[c] *<0.001* | 139 (143) |

Similar letters indicate group comparison performed between Iraqis and Swedes in comparability between methods using an independent samples t-test: **a)** p<0.001; **b)** p<0.001; c) p<0.001.

Percent difference for paired comparisons is calculated as (Self-reported PA – Accelerometer PA)/Accelerometer PA * 100.

Test of difference between methods was performed by a paired samples t-test.