The “Saltin-Grimby Physical Activity Level Scale” and its Application to Health Research

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The original version of the leisure time physical activity questionnaire (Saltin, Grimby 1968) - cited 555 times (May 2015)

Group 1 *Being almost completely inactive*: reading, TV watching, movies etc.
Group 2 *Some physical activity during at least 4 hrs per week*, riding a bicycle or walking to work, walking or skiing with the family, gardening.
Group 3 *Regular activity such as* heavy gardening, running, calisthenics, tennis etc.
Group 4 *Regular hard physical training for competition*: in running events, soccer, racing, European handboll etc. Several times per week.
Types of modifications

Added various examples as in
- Level 1 computers
- Level 2 light house chores, fishing, table tennis, bowling
- Level 3 golf, jogging, aerobic exercise, dancing, swimming, playing football, badminton
- Level 4 skiing, swimming, long-distance running, orienteering
Added duration requirements compared to the original version

- **Level 1** Light physical activity (PA) <2 hrs/w (in original version no time)
- **Level 2** Light PA 2-4 hrs/w, light PA 1-4 hrs/w, light PA at least 2 hrs/w, light PA >3hrs/w (in original at least 4 hrs/w)
- **Level 3** Light PA >4hrs/w or more vigorous PA 2-4 hrs/w, moderate PA 1-3 hrs/w, at least 2 hrs/w, 2-3 hrs/w, at least 3 hrs/w, 4 hrs/w (in original no time)
- **Level 4** Vigorous PA >4hrs/w, 5hrs/w
SGPALS (Rödjer et al 2012)

Added modifications are underlined

*Level 1* Sedentary. *Being almost completely inactive*: reading, TV watching, movies, using computers or doing other sedentary activities during leisure time.

*Level 2* Some physical activity during at least 4 hrs per week: riding a bicycle or walking to work, walking or skiing with the family, gardening, *fishing*, *table tennis*, *bowling* etc.

*Level 3* Regular physical activity and training (moderate PA): heavy gardening, running, *swimming*, playing tennis, *badminton*, calisthenics and similar activities for at least 2 to 3 hours/week.

*Level 4* Regular hard physical training for competition sports (vigorous PA): running events, *orienteering*, skiing, swimming, soccer, European handball etc. Several times per week.
Use of the questionnaire
Specific groups (number of participants given) as:
Former athletes (29), revision hip arthroplasty (1535), pregnant women (5749).

Populations studies as:
1913-years men (793) and Primary preventive study in Göteborg (7395), MONICA study (22289+), Women study in Göteborg (1405), Men born 1914 Malmö (363), SCAPIS study in Sweden (around 30000), Copenhagen City Heart Study (7023), Tromsø studies (40000+), Norwegian counties study (376682), Oslo Study (around 16000 + 18000), Romsås in Motion (2950), Eastern Finland (15088), Helsinki Heart Study (23531), Helsinki Policemen Study (970).
Concurrent validity
No obvious “gold standard”

Maximal oxygen uptake (usually estimated): In 42 years old subjects for levels 1, 2, 3 and 4 successively increasing (Saltin 1977). In 1913-years old men significant higher (p<0.005) in levels 3 and 4 than in level 1 and 2 combined (Wilhelmsen et al 1976).
Correlation (r=0.40-0.44) (Emaus et al 2010).
Correlation (r=0.24) (Loe et al 2013).
Correlation (r= 0.27) (Olsson et al 2015).
Correlation ( r=0.16) (Ekblom et al 2015).
Objectively measured physical activity:

*Position and motion instrument ActiReg*

correlation $r = 0.64$ (Mathiesen et al 2008)

*Activity measured with Double water method*

good agreement (Johansson & Westertorp 2008)
Predictive validity
Associated with coronary risk factors, however, more closely related to physical fitness than to physical activity (Thelle 1976).

Discriminates:
different levels of BMI and serum cholesterol (Aires et al 2003).
major cardiovascular risk factors, as smoking, triglycerides, high and low density lipoproteins, overweight, resting heart rate, resting plasma glucose (Rödjer et al 2012).
metabolic syndrome (Ekblom et al 2015).
Prediction of mortality and morbidity:

- cardiovascular, cancer and all cause mortality (e.g. Rosengren et al 1997, Barengo et al 2005, Schnohr et al 2006)
- diabetes type 2 (Jacobsen et al 2002)
- fractures (Joakimsen et al 1998) and hip fractures (Trimpou et al 2010)
- stress-related disease (Jonsdottir et al 2010) and self-perceived stress (Rödjer et al 2012)
- self-perceived workability (Arwidson et
Reproducibility

Batty et al (2000)
- kappa value 0.64 in 41 men with maintained PA level and administration by personal interview 4-6 weeks apart

- agreement 86% in 29 subjects and self-reported questionnaire one month apart
SUMMARY

• The questionnaire for PA has since 1968 been used in more than 600000 subjects, many in large scale population studies.
• Different modifications with more current examples of activity and various duration requirements, especially for levels 2 and 3.
• Significant (moderate to low) correlations have been shown between PA and maximal oxygen uptake. Correlations have been shown to accelerometer assessed PA.
• Prediction is shown for morbidity and various risk factors for health conditions.
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