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BRIEF REPORT

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A resistance exercise set for a total body workout for adults with intellectual disabilities, a pilot study

Stijn Weterings[1,2] | Alyt Oppewal[1] | Florien M. M. van Eeden[1,3] | Thessa I. M. Hilgenkamp[1]

[1]Intellectual Disability Medicine, Department of General Practice, Erasmus MC University Medical Centre, Rotterdam, The Netherlands

[2]Abrona, Healthcare Provider for People with an Intellectual Disability, Huis ter Heide, The Netherlands

[3]Medical Sciences Program, Erasmus MC University Medical Center, Rotterdam, The Netherlands

Correspondence
Stijn Weterings, Department of General Practice, Intellectual Disability Medicine, Rotterdam, The Netherlands.
Email: s.weterings@erasmusmc.nl

Abstract

Background: Resistance training has beneficial effects on fitness levels, cardiovascular disease risk, risk of sarcopenia and on performing activities of daily living. The focus of this study is to design a total body resistance exercise set for adults with intellectual disabilities (RESID) with minimal equipment required and to test its feasibility.

Method: The RESID was selected in an expert meeting, and its feasibility was determined in a cross-sectional pilot study. The feasibility was determined with completion rate, correct execution of exercises and the participant's experience.

Results: The expert group (n = 7) selected seven exercises for the RESID. The participants (N = 11) performed the RESID twice during regular sports classes. Completion rate and correctness were excellent for all exercises. The participants did not experience any major problems with the RESID.

Conclusions: The RESID is feasible for use in different training settings. A physiotherapist or fitness instructor is required to supervise the training sessions.

KEYWORDS

adults, exercise set, intellectual disability, resistance training, total body workout

1 | INTRODUCTION

Physical activity (PA) is important to maintain physical and psychological health (World Health Organization, 2003). However, only a small proportion of adults with intellectual disabilities are physically active at a level that is compliant with public health recommendations (Hilgenkamp, Reis, van Wijck, & Evenhuis, 2012; Peterson, Janz, & Lowe, 2008). Additionally, their fitness levels are very low (Hilgenkamp, van Wijck, & Evenhuis, 2012; Oppewal, Hilgenkamp, van Wijck, & Evenhuis, 2013).

To increase health and physical fitness, aerobic training (AT) is traditionally recommended, but resistance training (RT) is nowadays also recommended (ACSM, 2013; Colberg et al., 2010). RT has potential additional benefits in comparison to AT. RT focuses on increasing muscle strength, which has positive effects on performing activities of daily living (ADL) and for reducing the age-related decline in muscle mass, called sarcopenia (Beltran Valls et al., 2014; Savage et al., 2011). Furthermore, in sedentary older adults, compliance rates seem to be higher in RT programs than in AT programs (Dunstan et al., 2002; Hong, Hughes, & Prohaska, 2008).

The ACSM guidelines give clear recommendations for health-improving RT: all large muscle groups need to be trained at vigorous intensity (ACSM, 2013). However, it is often difficult for adults with intellectual disabilities to perform RT exercises adequately, because they often have motor control issues; can have motivational problems; require more encouragement; often use PA-influencing medication; and generally have a shorter attention span (ACSM, 2013). Therefore, the ACSM recommends that simple instructions and

close supervision have to be provided (ACSM, 2013). Also, because of the motor control issues, the use of weight machines during training is recommended (ACSM, 2013). However, in daily practice, many adults with intellectual disabilities are less likely to have the opportunity to access these kinds of training facilities.

There are only few studies done with an RT program for people with intellectual disabilities. These studies used fitness equipment (Calders et al., 2011; Carmeli, Zinger-Vaknin, Morad, & Merrick, 2005; Machek, Stopka, Tillman, Sneed, & Naugle, 2008; Mendonca, Pereira, & Fernhall, 2011; Podgorski, Kessler, Cacia, Peterson, & Henderson, 2004; Shields, Taylor, & Dodd, 2008; Suomi, 1998) and/or did not describe the exercises used (Carmeli et al., 2005; Podgorski et al., 2004). A resistance exercise set for a total workout, without weight machines, that is feasible for adults with intellectual disabilities, would make resistance training more accessible for a larger number of adults with intellectual disabilities and potentially align future research.

Therefore, the focus of this study was to design a resistance exercise set for a total body workout for adults with mild or moderate intellectual disabilities (RESID), without the use of weight machines, and to determine its feasibility.

2 | METHOD

2.1 | Study design

This study consisted of an expert meeting to select appropriate exercises for the RESID, and a pilot study to test the selected exercises for feasibility (Bowen et al., 2009; Thabane et al., 2010). This study was part of the "Healthy Aging and Intellectual Disabilities" consortium; a consort of three care providers for people with intellectual disabilities in the Netherlands, Abrona (Huis ter Heide), Ipse de Bruggen (Zoetermeer) and Amarant (Tilburg) in collaboration with the Chair for Intellectual Disability Medicine of the Erasmus MC, University Medical Centre Rotterdam (Hilgenkamp et al., 2011).

2.2 | The expert meeting

Representatives of six physiotherapy teams and four teams of physical activity instructors of the three care providers were invited to the expert meeting. A semi-structured interview format was used, which allowed the group to discuss main topics and to explore unanticipated topics as they arose from the group's discussion (Berg & Lune, 2011). The experts discussed the following: (a) Which conditions determine the feasibility of RT exercises (i.e., safety, support, duration, setting)?, (b) How to motivate participants (motivation techniques, do's and don'ts)?, (c) Which exercises for the RESID would be most feasible for a total body workout for adults with intellectual disabilities in accordance with existing guidelines (6–8 large muscle groups; concentric, eccentric and isometric; multi-joint and single-joint exercises) (ACSM, 2013; Colberg et al., 2010; Haskell et al., 2007)? The aim was to reach a broad consensus on all topics.

2.3 | Pilot study

The pilot study regarding the feasibility of the RESID was held during regular sports classes of the participating care providers Amarant and Ipse de Bruggen (convenience sample). To participate in the pilot study, participants had to be 18 years or older, diagnosed with a mild (IQ = 50–69) or moderate (IQ = 35–49) intellectual disability and participate in these sport classes. These sports classes are given once a week for adults with mild to moderate intellectual disabilities. Both groups normally performed aerobic exercises (cycling or treadmill walking) and/or fitness exercises with weight machines. Within these sport classes, 13 potential participants with a mild (n = 11) and moderate (n = 2) intellectual disability were asked to participate, of which eleven participants (six male, ten mild intellectual disability) provided informed consent. Participants were excluded when significant physical problems inhibited exercise participation when there was no medical clearance provided by their physician.

The pilot study consisted of two training sessions. A physical activity instructor or physical therapist explained and demonstrated each exercise to the group. The participants performed two sets of ten repetitions per exercise. Exercises were performed without weights for safety reasons. During exercising, the instructor positively motivated and supported the participants as much as needed. The warming-up and cooling down (both 5–10 min) consisted of easy cycling or treadmill walking.

2.4 | Participant characteristics

The participant characteristics (age, sex and level of intellectual disability) were recorded at the start of training one.

2.5 | Workout characteristics

Attendance was recorded at the start of training. Tailoring of the exercises was recorded when exercises were adapted to meet the physical and mental capabilities of the participants.

2.6 | Feasibility

The feasibility of the RESID was scored on the parameters "completion rate," "correctness of exercise execution," and "participants' experience."

2.6.1 | Completion rate

Completion rate of each exercise of the RESID was defined as the percentage of participants completing two sets of ten repetitions characterized as low (<25%), moderate (≥25%–<50%), good (≥50%–<75%), and excellent (≥75%) (Hilgenkamp, van Wijck, & Evenhuis, 2013).

2.6.2 | Correctness of exercise execution

Correctness of the execution of each exercise was defined as the percentage of participants capable of performing the exercise safe

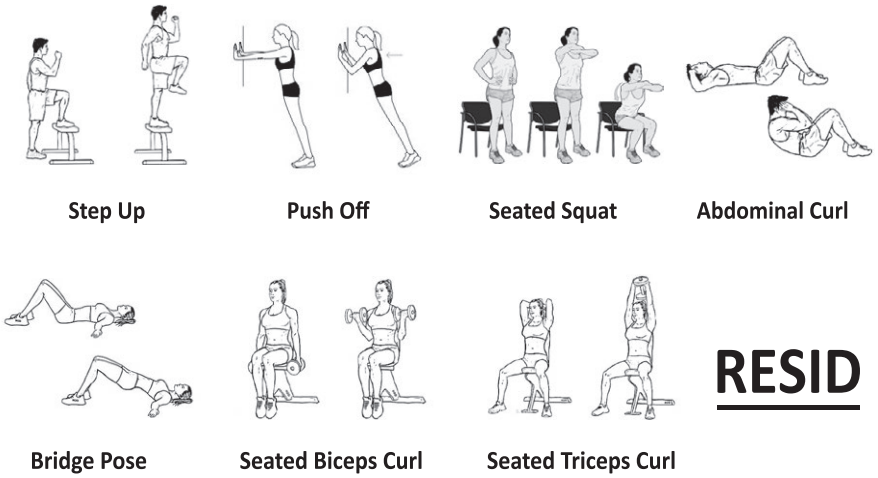

FIGURE 1 The exercises for a total body workout of the Resistance Exercise Set for adults with Intellectual Disabilities (RESID).

and with good posture and technique characterized as low (<25%), moderate (≥25%–<50%), good (≥50%–<75%) and excellent (≥75%) (Hilgenkamp et al., 2013). The researchers, who were present during the training, evaluated this.

2.6.3 | Participants' experience

A custom-made questionnaire was used to evaluate the experience of the participants with each exercise. The questionnaire gave insight into the experience, the difficulty and the acceptance of the participants regarding each exercise. Participants could mostly respond on a 5-point Likert scale. Some questions were open questions, so participants could give feedback in their own words.

2.6.4 | Feasibility

The overall feasibility of the RESID based on these three parameters was interpreted as (Thabane et al., 2010):

1. feasible without adaptations necessary, when the completion rate and correctness were good to excellent, and no major problems arose from the participants' experience for all exercises of the RESID.
2. feasible with adaptations necessary, when the completion rate and correctness were less than good in both training sessions, and/or a major problem arose from the participants' experience for one or more exercises of the RESID.
3. not feasible, when both completion rate and correctness were low in both training sessions, and/or multiple major problems arose from the participants' experience for multiple exercises of the RESID.

2.7 | Statistical analyses

Baseline characteristics (age, sex, level of intellectual disability), attendance, completeness and correctness were analysed with descriptive statistics. Participants' experiences were analysed with descriptive statistics and feedback of the participants was described. Data were analysed with SPSS version 21 (IBM Corporation, New York).

2.8 | Ethical considerations

Participants and/or their legal representatives provided informed consent. The Medical Ethical committee of the Erasmus MC, University Medical Centre Rotterdam approved this study (MEC-2016-242).

3 | RESULTS

3.1 | Expert meeting

Five physiotherapists (out of six invited) and two physical activity instructors (out of four invited) participated in the expert meeting (n = 7).

3.1.1 | Conditions for RT exercises

The experts stated that from a motivational perspective, the less exercises the better. Because of the often short attention span, the maximal duration of a session should be 60 min. Furthermore, special attention is required for the breathing instructions during exercising, because most adults with intellectual disabilities tend to hold their breath during exercising.

3.1.2 | Motivating participants to perform the RT exercises

The experts raised motivation as the key topic with regard to the compliance with RT exercises. Besides using music and simple games to enhance compliance, as mentioned in the ACSM guidelines (ACSM, 2013), the experts added that maximal external motivation (from caregivers and/or family), humour during training, positive reinforcement and rewards should be used to stimulate enjoyment.

TABLE 1 Attendance of both training sessions

Participants	Total number of participants (%)	Training 1—number of participants present (%)	Training 2—number of participants present (%)
Total	11 (100)	10 (91)	7 (64)
Sex			
Male	6 (55)	6 (60)	5 (71)
Female	5 (45)	4 (40)	2 (29)
Level of intellectual disability			
Mild	10 (91)	9 (90)	6 (86)
Moderate	1 (9)	1 (10)	1 (14)

3.1.3 | Selected exercises for the RESID

The experts stated that alternative exercises without weight machines are possible. The motor control issues of adults with intellectual disabilities however stress the need for easy and safe exercises. Because of the large variety in physical capabilities, it was considered important that the exercises of the RESID can be tailored to the physical capabilities of an individual. The researchers used 46 exercises as a starting point for a group discussion. Consensus was reached on a set of seven exercises (Figure 1). The seven exercises are considered a core set, which can easily be tailored to the capabilities of the individual (see Appendix 1 for examples).

3.2 | Pilot study

3.2.1 | Participant characteristics

Eleven participants (six male, ten mild intellectual disability) participated in the pilot study. The mean age was 28.7 (±8.1) years (range 19–44) (Table 1).

3.2.2 | Workout characteristics

The total attendance of both training sessions was 77% (17/22 sessions). Seven participants joined both of the trainings sessions (64%) (Table 1). One participant did not join either one of the sessions after providing informed consent (9%), because of a lack of motivation for exercising. Three participants skipped session two, because of other social appointments.

Two exercises of the RESID were tailored to the physical capabilities of the participants. Because the seated squat was too difficult to perform for eight participants, this exercise was altered by squatting with a ball behind their back against the wall. The push off was replaced by a push-up for four participants (one with knee support), because the push off was too easy.

3.2.3 | Completion rate

In the first session, all two sets of ten repetitions were performed for the step up, the biceps curl and the triceps curl (100% completion rate). One participant performed just one set of the push-up, because of not liking the exercise in this first session, resulting in a 90% completion rate for this exercise. One participant did not perform the seated squat, the abdominal curl and the bridge pose, because of back pain, resulting in a 90% completion rate for those exercises. In the second session, all participants performed all sets and repetitions of all exercises, resulting in an excellent completion rate (100%).

3.2.4 | Correctness of exercise execution

In the first session, all participants performed the step up (100%) and the push off (100%) correctly. Only one participant could not correctly perform the seated squat (90%), abdominal curl (90%), bridge pose (90%), and the biceps and triceps curls (90%). In the second session, all participants performed all exercises correctly (100%), which results in an excellent completion rate.

3.2.5 | Participants' experience

The exercises were liked by 70–100% of the participants from much to very much, and 70–100% of the participants wanted to perform the exercises again during their regular sports classes. Two participants found the seated squat and push off difficult to perform and one participant found the abdominal curl and bridge pose difficult. The biceps curl was the only exercise all participants wanted to perform again.

4 | DISCUSSION

The purpose of this study was to design a feasible resistance exercise set for a total body workout for adults with mild or moderate intellectual disabilities (RESID), which can be performed without the use of weight machines. The completion rate of the exercises was excellent (90–100%), as well as the correctness of execution (89–100%).Overall, the participants liked the exercises and found them easy to perform. Therefore, the RESID seems feasible for adults with mild to moderate intellectual disabilities and has the potential to be used in RT programs.

The RESID is a core set of exercises and can be tailored to the physical capabilities of an individual with an intellectual disability,

without changing the essence of an exercise (Appendix 1). This is in line with the recommendation of the experts in this study and the ACSM to individualize exercise training (ACSM, 2013). Professional expertise is required to tailor the exercises of the RESID adequately.

This is the first study to develop a feasible, weight machine free, resistance exercise set for a total body workout specifically for adults with mild to moderate intellectual disabilities, which has the potential to be used in a RT program. Strong aspects of this study were that the RESID was designed with the expert knowledge of movement experts experienced in working with adults with intellectual disabilities, within the guidelines for resistance training of the ACSM (ACSM, 2013). Furthermore, the heterogeneity of the participants in the pilot (age, sex) provides confidence that the results can be feasible for a larger group of adults with a mild and moderate intellectual disabilities, even more because the exercises can be tailored to the physical capabilities of the participants.

A limitation is that a small convenience sample of attendants of sport classes was used for this study. Therefore, participants were probably more active and motivated to exercise. Furthermore, just one participant with a moderate intellectual disability was included. These aspects limit generalization of the results to the population of adults with intellectual disabilities. For safety reasons, the exercises were performed without weights. So, even though the performance (completion and correctness) of the exercises was excellent, it remains unclear how adults will perform the exercises with weights, and as part of an RT program.

Future research should therefore study if the RESID is feasible in a larger group of adults with intellectual disabilities and if they are able and willing to perform the RESID in an RT program with increasing weights at moderate or vigorous intensity. This will be our main question in our next study into the feasibility of a 24-week RT exercise program, with the RESID as selected exercises.

5 | CONCLUSION

The RESID is a feasible resistance training exercise set for adults with mild or moderate intellectual disabilities and has the potential to be used in different training settings without the need of expensive weight machines. The RESID seems a feasible core set of exercises in daily practice, with the possibility to tailor one or more exercises to the physical capabilities and physical fitness of each adult with an intellectual disability. A physiotherapist, physical activity instructor or fitness instructor needs to be available to closely supervise the training sessions and adapt exercises where necessary.

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ETHICS COMMITTEE

The medical ethics committee of the Erasmus Medical Centre at Rotterdam, the Netherlands. Approval number: MEC-2016-242.

ORCID

Stijn Weterings https://orcid.org/0000-0003-4751-7851
Alyt Oppewal https://orcid.org/0000-0001-6630-8807
Thessa I. M. Hilgenkamp https://orcid.org/0000-0001-9882-163X

REFERENCES

American College of Sports Medicine. (2013). ACSM's guidelines for exercise testing and prescription. In L. Pescatello (Ed.), (9th ed., pp. 179–186, 299–304). Philadelphia, PA: Wolters Kluwer/Lippincott Williams & Wilkins Health.

Beltran Valls, M. R., Dimauro, I., Brunelli, A., Tranchita, E., Ciminelli, E., Caserotti, P., … Caporossi, D. (2014). Explosive type of moderate-resistance training induces functional, cardiovascular, and molecular adaptations in the elderly. *Age (Dordrecht)*, *36*(2), 759–772. https://doi.org/10.1007/s11357-013-9584-1

Berg, B. L., & Lune, H. (2011). *Qualitative research methods for the social sciences* (8th ed.). Harlow, Essex, UK: Pearson.

Bowen, D. J., Kreuter, M., Spring, B., Cofta-Woerpel, L., Linnan, L., Weiner, D., … Fernandez, M. (2009). How we design feasibility studies. *American Journal of Preventive Medicine*, *36*(5), 452–457. https://doi.org/10.1016/j.amepre.2009.02.002

Calders, P., Elmahgoub, S., Roman de Mettelinge, T., Vandenbroeck, C., Dewandele, I., Rombaut, L., … Cambier, D. (2011). Effect of combined exercise training on physical and metabolic fitness in adults with intellectual disability: A controlled trial. *Clinical Rehabilitation*, *25*(12), 1097–1108. https://doi.org/10.1177/0269215511407221

Carmeli, E., Zinger-Vaknin, T., Morad, M., & Merrick, J. (2005). Can physical training have an effect on well-being in adults with mild intellectual disability? *Mechanisms of Ageing and Development*, *126*(2), 299–304. https://doi.org/10.1016/j.mad.2004.08.021

Colberg, S. R., Sigal, R. J., Fernhall, B., Regensteiner, J. G., Blissmer, B. J., Rubin, R. R., … Association, A. D. (2010). Exercise and type 2 diabetes: American College of Sports Medicine and American Diabetes Association: Joint position statement executive summary. *Diabetes Care*, *33*(12), 2692–2696. https://doi.org/10.2337/dc10-1548

Dunstan, D. W., Daly, R. M., Owen, N., Jolley, D., De Courten, M., Shaw, J., & Zimmet, P. (2002). High-intensity resistance training improves glycemic control in older patients with type 2 diabetes. *Diabetes Care*, *25*(10), 1729–1736. https://doi.org/10.2337/diacare.25.10.1729

Haskell, W. L., Lee, I.-M., Pate, R. R., Powell, K. E., Blair, S. N., Franklin, B. A., … Bauman, A. (2007). Physical activity and public health: Updated recommendation for adults from the American College of Sports Medicine and the American Heart Association. *American College of Sports Medicine: Medicine & Science in Sports & Exercise*, *39*(8), 1423–1434.

Hilgenkamp, T. I. M., Bastiaanse, L. P., Hermans, H., Penning, C., van Wijck, R., & Evenhuis, H. M. (2011). Study healthy ageing and intellectual disabilities: Recruitment and design. *Research in Developmental Disabilities*, *32*(3), 1097–1106. https://doi.org/10.1016/j.ridd.2011.01.018

Hilgenkamp, T. I. M., Reis, D., van Wijck, R., & Evenhuis, H. M. (2012). Physical activity levels in older adults with intellectual disabilities are extremely low. *Research in Developmental Disabilities*, *33*, 477–483. https://doi.org/10.1016/j.ridd.2011.10.011

Hilgenkamp, T. I. M., van Wijck, R., & Evenhuis, H. M. (2012). Low physical fitness levels in older adults with ID: Results of the HA-ID study. *Research in Developmental Disabilities*, *33*(4), 1048–1058. https://doi.org/10.1016/j.ridd.2012.01.013

Hilgenkamp, T. I. M., van Wijck, R., & Evenhuis, H. M. (2013). Feasibility of eight physical fitness tests in 1,050 older adults with intellectual disability: Results of the healthy ageing with intellectual disabilities study. *Intellectual and Developmental Disabilities*, *51*(1), 33–47. https://doi.org/10.1352/1934-9556-51.01.033

Hong, S. Y., Hughes, S., & Prohaska, T. (2008). Factors affecting exercise attendance and completion in sedentary older adults: A meta-analytic approach. *Journal of Physical Activity and Health*, *5*(3), 385–397. https://doi.org/10.1123/jpah.5.3.385

Machek, M. A., Stopka, C. B., Tillman, M. D., Sneed, S. M., & Naugle, K. E. (2008). The effects of a supervised resistance-training program on Special Olympics athletes. *Journal of Sport Rehabilitation*, *17*(4), 372–379. https://doi.org/10.1123/jsr.17.4.372

Mendonca, G. V., Pereira, F. D., & Fernhall, B. (2011). Effects of combined aerobic and resistance exercise training in adults with and without Down syndrome. *Archives of Physical Medicine and Rehabilitation*, *92*(1), 37–45. https://doi.org/10.1016/j.apmr.2010.09.015

Oppewal, A., Hilgenkamp, T. I., van Wijck, R., & Evenhuis, H. M. (2013). Cardiorespiratory fitness in individuals with intellectual disabilities – A review. *Research in Developmental Disabilities*, *34*(10), 3301–3316. https://doi.org/10.1016/j.ridd.2013.07.005

Peterson, J. J., Janz, K. F., & Lowe, J. B. (2008). Physical activity among adults with intellectual disabilities living in community settings. *Preventive Medicine*, *47*, 101–106. https://doi.org/10.1016/j.ypmed.2008.01.007

Podgorski, C. A., Kessler, K., Cacia, B., Peterson, D. R., & Henderson, C. M. (2004). Physical activity intervention for older adults with intellectual disability: Report on a pilot project. *Mental Retardation*, *42*(4), 272–283. https://doi.org/10.1352/0047-6765(2004)42<272:PAIFOA>2.0.CO;2

Savage, P. A., Shaw, A. O., Miller, M. S., VanBuren, P., LeWinter, M. M., Ades, P. A., & Toth, M. J. (2011). Effect of resistance training on physical disability in chronic heart failure. *Medicine and Science in Sports and Exercise*, *43*(8), 1379–1386. https://doi.org/10.1249/MSS.0b013e31820eeea1

Shields, N., Taylor, N. F., & Dodd, K. J. (2008). Effects of a community-based progressive resistance training program on muscle performance and physical function in adults with Down syndrome: A randomized controlled trial. *Archives of Physical Medicine and Rehabilitation*, *89*(7), 1215–1220. https://doi.org/10.1016/j.apmr.2007.11.056

Suomi, R. (1998). Self-directed strength training: Its effect on leg strength in men with mental retardation. *Archives of Physical Medicine and Rehabilitation*, *79*(3), 323–328. https://doi.org/10.1016/S0003-9993(98)90014-4

Thabane, L., Ma, J., Chu, R., Cheng, J., Ismaila, A., Rios, L. P., … Goldsmith, C. H. (2010). A tutorial on pilot studies: The what, why and how. *BMC Medical Research Methodology*, *10*, 1. https://doi.org/10.1186/1471-2288-10-1

World Health Organization (2003). *Health and development through physical activity and sport*. Geneva, Switzerland: World Health Organization.

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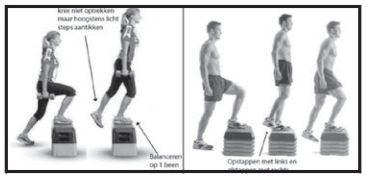
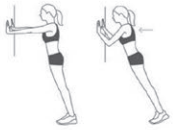
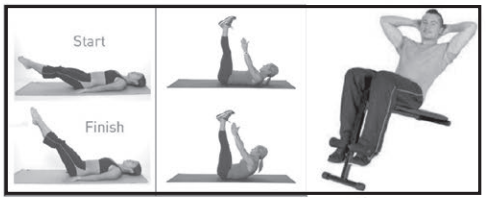
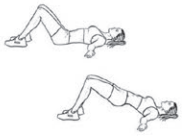
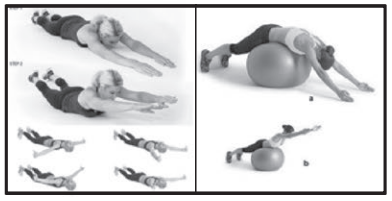
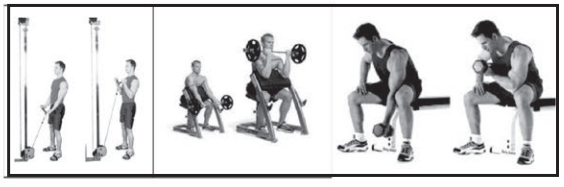
APPENDIX

Alternative exercises for the RESID

RESID	Alternative exercises
Step up	 
Push off	 
Seated squat	 
Abdominal curl	 
Bridge pose	 
Biceps curl	 
Triceps curl