Effect of elevation training mask 2.0 on Rating Perceived Exertion (RPE) during resistance exercise

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Abstract
Popular exercise training device has been developed recently, which had been promoted by companies as an ergogenic aid, knows as a Restrictive Breathing Mask or Elevation Training Mask. Elevation Training Mask will reduce the muscle peak velocity by wearing the mask combined with weight training. Most of the study are looking for the ventilation but limited study done for the muscle fiber recruitment. Limited research is available regarding adaptation in strength performance when Elevation Training Mask is combined with resistance exercise programed. Therefore, the main objective of this study was to examine the effect of Elevator Mask training on Rating Perceived Exertion on the resistance exercise in healthy active subject. This study was the cross-over experimental design. 14 healthy subjects with 1-year experience in resistance exercise went through the two experimental trials: 70% resistance exercise with Elevation Training Mask and 70% resistance exercise without Elevation Training Mask. Each trial was separated one week apart to ensure the full recovery from the previous intervention. For the Elevation Training Mask trial, subjects were required to perform a 50% of 1-RM bench press for warming up and rest 2 minutes followed by performing the 70% of 1-RM bench press with the Elevation Training Mask on. For the experimental trail Without the Elevation Training Mask, similar protocol was applied. The subjects were required to perform a 50% of 1-RM bench press for warming up and rest 2 minutes followed by performing the 70% of 1-RM bench press without the Elevation Training Mask. The major findings of this study were that no significant differences between groups (With and Without Elevation Mask) on RPE scores, results also revealed that no significantly different within set during resistance exercise. The influence of wearing the Elevation Training Mask can be explained considering the unpleasant sensation caused by the accessory. This relation was observed through a relation between brain structures that process the fatigue sensation and performance.

Keywords: Elevation Training Mask 2.0, Rating Perceived Exertion (RPE)

Introduction
Popular exercise training device has been developed recently, which had been promoted by companies as an ergogenic aid, knows as a restrictive breathing mask. This device is to make to mimic the high altitude training, which the mask can be restricted the oxygen consumption. This type of training also started to grown in the popularity among professional athletes. But is that a very useful device to help athlete gain the sufficient benefit from the still have limited study had been going through this training method. Investigated into the effect of a restrictive breathing mask during resistance exercise has yet to be established; however, this product is often used by cross-training athletes. Resistance exercise has been recognized as stimulus for muscle protein synthesis and governed by the intracellular signalling pathway. Know that the reduce of the training volume and reduction of the repetition could negatively affect muscle hypertrophy. So that it is for worthwhile to examine the training mask into the anaerobic.

Restrictive breathing mask training will reduce the muscle peak velocity by wearing the mask combined with weight training. Most of the study are looking for the ventilation but limited study done for the muscle fiber recruitment (Jagim *et al*., 2018) [5] The device becoming popular can see had some professional martial art player are start wearing to their training. If the mask giving the negative effect to the Vo2 at the same time affecting the muscle peak velocity do the player really will get the benefit from the device. Limited research is available regarding adaptation in strength performance when a restrictive breathing mask is combined with resistance exercise programed (Jagim *et al*., 2018) [5].

Therefore, the main objective of this study was to examine the effect of Elevation Training Mask on Rating Perceived Exertion on the resistance exercise in healthy active subject.

Methods

This study was the cross-over experimental design. 14 healthy subjects with 1-year experience in resistance exercise went through the two experimental trials: 70% resistance exercise with Altitude Mask and 70% resistance exercise without Altitude Mask Each trial was separated one week to ensure the full recovery from the previous intervention.

For the Elevation Training Mask trial, subjects were required to perform a 50% of 1-RM bench press for warming up and rest 2 minutes followed by performing the 70% of 1-RM bench press with the Elevation Training Mask on. For the experimental trail Without the Elevation Training Mask, similar protocol was applied. The subjects were required to perform a 50% of 1-RM bench press for warming up and rest 2 minutes followed by performing the 70% of 1-RM bench press without the Elevation Training Mask.

The Rating Perceived Exertion (RPE) scores were recorded after each set. At such, subjects when they were with the Elevation Training Mask, they will focus on the breathing more than the lifting technique which may affect their RPE scores during the resistance exercise.

Instruments used in this study were the Altitude Training Mask 2.0 (USA, 2018) as Figure 1 and the Rating Perceived Exertion (RPE: Borg, 1982) [2] as the rating scores in Table 1.

Fig 1: Elevator Training Mask 2.0 (USA, 2018)

Table 1: Rating Perceive Exertion (RPE) scale used for this study

Rating	Descriptor
0	Rest
1	Very, very easy
2	Easy
3	Moderate
4	Somewhat hard
5	Hard
6	Hard
7	Very Hard
8	Very Hard
9	Very Hard
10	Maximal

The Borg rating of perceived exertion (RPE) scale was originally developed to prescribe endurance training intensity. Resistance training is an essential component of all training programs in sports and health. Therefore, the quantification and control of variables such as intensity, volume and frequency, and their relationship to training goals (such as increasing strength, power, and muscular hypertrophy or endurance), is essential to have an accurate exercise prescription. Controlling intensity is a key factor in relating the type of adaptation and goal achievement for differing training programs. However, intensity for resistance training has many definitions. In some cases, resistance training intensity has been associated with the percentage of 1 repetition maximum (1RM) load or the resistance associated with a specific number of repetitions per set where an RM target, such as a 10RM, or an RM target zone, such as a 6–8RM, is used to prescribe intensity.

Another study by Robertson *et al*. (Robertson, 2003) [8] who examined 2 single-joint exercises, Lagally *et al*. (Lagally, 2004) [6] analyzed the perception of effort measured by a 15-category Borg perceived exertion scale produced by a group of recreational and novice resistance training women after 2 sets of bench press (multijoint exercise) at 60 and 80% of 1RM. The authors found that global, or feelings of whole-body exertion, and the local muscular RPE were significantly related to the percentage of 1RM load and electromyography muscle activity during the workout. However, it is important to note that in this study the

repetitions performed did not achieve muscle failure, and it is known that RPE increases as a function of the number of repetitions irrespective of the magnitude of each particular load (Robertson, 2003) [8].

Therefore, the application of RPE to control resistance training intensity should be at the beginning of the set to estimate the amount of resistance used and at the end to reflect the relative effort performed by the subject. However, no previous study has applied this type of methodology to control resistance training intensity at the beginning and at the end of the exercise sets. Additionally, there are few studies that have measured resistance training exercise power or velocity during the continuous sets until muscular failure. Izquierdo (2006) [4] observed a significant fall in movement velocity at 34–40 or 48–69% of the maximum possible number of repetitions to muscular failure with the 60, 65, 70, and 75% of 1RM in the bench press and squat, respectively. In that study, the authors analyzed the velocity reached in all the repetitions of each set but did not control or measure the exertion perceived by the subject during or at the end of each test.

Procedures

All subjects were required to fill up the PAR-Q form and the Medical history questionnaire, participant information sheet and consent form prior to the preliminary testing. This procedure was to make sure that the subjects were healthy and to confirm the subjects' willingness to participate in this study.

Subjects were assigned randomly into either Altitude Mask Trial Group (70% of the 1-RM bench press with mask) or Without Altitude Mask Trial Group (70% of the 1-RM bench press without mask). The subsequent trial was conducted 1 week later for optimal recovery. RPE was recorded at all the set as the subjects completed their intervention. Subjects were required to maintain the weight and perform the 70% of the bench press.

Results

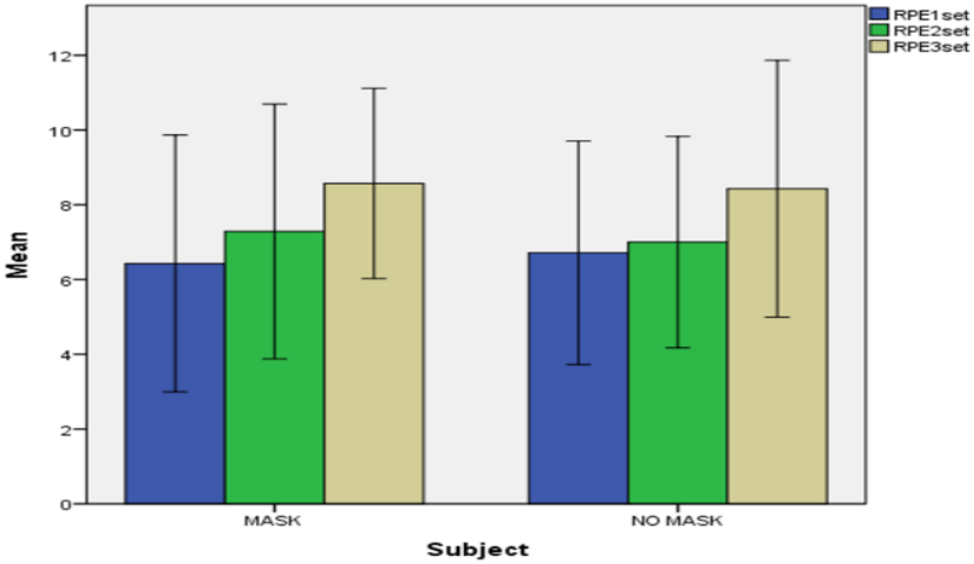

Fig 2: RPE for No Mask and Elevation Training Mask Conditions

Table 2: Rating Perceived Exertion (RPE) between Mask and No Mask Groups

RPESet	F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
								Lower	Upper
RPE1set	.006	.937	-.332	12	.746	-.286	.861	-2.162	1.590
RPE2set	.309	.588	.341	12	.739	.286	.837	-1.538	2.110
RPE3set	.124	.731	.177	12	.863	.143	.808	-1.618	1.904

Discussion

This study conducted with none-athletes that has compared the effects of resistance training with and without Elevation Mask during resistance exercise on Rating Perceived Exertion (RPE) scores. The major findings of this study were that no significant differences between groups (With and Without Elevation Mask) on RPE scores, results also revealed that no significantly different within set during resistance exercise. We speculate that the highest impairment of MASK may be explained by central fatigue theory (central governor model) because, independent of the real hypoxic condition, the RPE increased after exercise and blood lactate decreased. Lactate is a marker of glycolytic metabolism and intensity of exercise. There is a correlation between blood lactate concentration, exercise intensity, muscular tissue hypoxia, metabolic acidosis, and fatigue (Messonnier, Kristensen, Juel, & Denis, 2007) [7]

The RPE is used to indicate how people feel during and after physical exercise, that is, to measure perceptual intensities (Crewe, Tucker, & NoakesIt, 2008) [3] might be influenced by psychological (central factors), cardiorespiratory (e.g., ventilation), and metabolic factors (e.g., blood lactate) in the feed-forward mechanism (Bishop,

2012) [1]. In current study, the RPE observed in the Mask Group was greater than that of the No Mask Group, indicating that RPE may influence the fatigue process. The influence of wearing the Elevation Training Mask can be explained considering the unpleasant sensation caused by the accessory. This relation was observed through a relation between brain structures that process the fatigue sensation and performance (e.g., insular cortex) (Bishop, 2012) [1].

Some limitations to this study were the absence of hormonal response analyses (e.g., growth hormone, testosterone, and cortisol), micro-damage biomarkers (e.g., creatine kinase and lactate dehydrogenase), blood oxygen saturation, and electromyography. These physiological and biochemical parameters can improve our understanding of the difference between groups.

Resistance training is prescribed based on %1RM, the rating of perceived exertion (RPE) scale is often used to assist with standardizing training conditions between individuals. There are 2 types of RPE scales, which include the 6–20 category scale and 0–10 category ratio scale (CR-10), whereas the latter is considered better suited for resistance exercise. Resistance exercise intensity can be estimated from the RPE because the scale assesses subjective effort, strain, discomfort, and fatigue. However, several investigators have reported RPEs less than maximum during resistance exercise to volitional fatigue, indicating a mismatch between RPE and maximal effort.

In conclusion, wearing an Elevation Training Mask during resistance exercise did not yield any significant differences on perception of exertion in current study. Therefore, resistance exercise with an Elevation Training Mask provides neither the metabolic response expected nor an advantageous method for resistance training.

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