Mechanomyography based Muscle Movement Analysis: a Review

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COMPARATIVE EFFICACY OF IMAGERY-BASED RELAXATION AND ABBREVIATED MUSCLE RELAXATION TRAINING ON REACTION ABILITY OF NETBALL PLAYERS

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INTRODUCTION: Relaxation training as psychotherapeutic intervention technique involves an exercise training program tailored to help an individual under distressful condition to relax; to attain a state of increased calmness; lowering of blood pressure and decelerated cardiac activity etc. [1] and reduction in neuromuscular hypertension [2]. Imagery based relaxation training helps in identifying the unique tension sensation for that muscle group and then the tension is released to achieve a state of relaxation [3]. The present study intends to observe the relationship between alteration in autonomic competence facilitated by the relaxation training and the ultimate impact of the intervention on the visual reaction ability of the netball players.

Table 1: Means and mean differences in Visual Reaction Ability observed amongst three different groups across the experimental sessions.

Groups	Visual Reaction Time (in Sec.s)	
	Pre-intervention	Post-intervention
Control	36.39	34.17
Imagery-based relaxation - IRT	37.78	28.95
APMR	37.86	30.26
Mean Difference	-----	**(p < 0.01)

METHODS: Thirty six (36) competitive female netball players in the age range of 18 to 24 years were recruited. They were equally categorised into a Control group; Experimental Group I, who received Imagery-based relaxation intervention training and Experimental Group II, who received Abbreviated Progressive Muscle Relaxation (APMR) training. Participants were subjected to assessment of psychomotor variables (i.e., reaction time – RT; physiological (viz. resting heart-rate and Vo_2Max etc.) and psychobiological indices (such as, Sc components – latency; amplitude and recovery time. Upon completion of pre-intervention assessment, players of experimental groups (the control group that received no training) were subjected to their respective interventions (Imagery-based relaxation intervention training - IRT & APMR) which were imparted for 12 sessions (20 min /day; 2 days/ week for 6 weeks). After six weeks of intervention, post-intervention assessment on all of the psychological, psychomotor and psychobiological variables was done to all of the participants to verify the effect of training onto dependent measures.

RESULTS AND DISCUSSION: Table 1 reveals descriptive information as well as differences existent between groups across the measurements obtained in different phases of intervention. Based on the results, the findings of the pre-intervention analyses revealed no pre-existing differences, and hence alterations observed during the post-intervention analyses rationally could be attributed to the differential therapeutic interventions introduced to the participants of the experimental groups [4].

Table 2: Multiple linear regression outcomes (when participants who received training of IRT were only included).

Model *a* (Dep. Variable – Visual Reaction ability)	Unstandardized Coefficients		Standardized Coefficients	T	Sig.
	B	Std. Error	Beta		
Intercept	8.97	2.24		4.01	.000
Phasic Skin Conductance	1.35	.58	.54	2.33	.036
Orienting Amplitude	-2.53	.49	-.87	-5.16	.001
Recovery time	.66	.17	.92	3.88	.004
*(F(5, 31) = 8.09, p<0.002)), model adj. R² = 81.4%					

In Table 2, the model *a* emerged significant as the psychobiological measures such as phasic Sc, orienting amplitude and recovery time could explain 81.4% variance of changes in the extent of visual reaction time. Model *a* however explained direct relationships between predictor variables such as phasic Sc; and recovery time, while an inverse relationship between amplitude and reaction time was also evident. The equation here however implied that, the netball players who had relatively lower phasic Sc, but higher extent of amplitude and shorter, i.e., faster recovery could benefit mostly as they could regulate their task-focus well-enough to yield faster agile reaction performance [4,5].

CONCLUSION: Outcomes however suggested that both of the interventions facilitated in improvements in reaction ability, while in-depth contribution of autonomic components were evident.

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COMPARATIVE EFFICACY OF BIOFEEDBACK INTERVENTIONS IN PREDICTING IMPROVEMENTS IN SOCCER SHOOTING PERFORMANCE

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INTRODUCTION: Biofeedback intervention training have long been employed as psychotherapeutic intervention technique to assist in modulation of psychological adversities observed in clinical population, while application of differential modes of biofeedback training in the field of sports on Malaysian players is comparatively a newer phenomenon [1,2]. The present study intends to observe the relationship between alteration in autonomic competence facilitated by the skin conductance (Sc) as well as electromyography (EMG) biofeedback training and the outcome of the intervention on the bilateral shooting ability of the soccer players.

METHODS: Altogether 45 young competitive soccer players in the age range of 20 to 26 years were recruited. They were equally categorized into a Control group; Experimental Group I, who received Sc biofeedback training and Experimental Group II, received EMG biofeedback training. They were subjected to assessment of reaction time – RT; and psychobiological indices (such as, Sc components – latency; amplitude and recovery time. Upon completion of pre-intervention assessment, players of experimental groups were subjected to their respective interventions (Sc & EMG biofeedback training) which were imparted for 24 sessions (15 min/day; 2 days/week for 12 weeks). After twelve weeks of intervention, post-intervention assessment on all of the psychological, psychomotor and psychobiological variables as well as on soccer shooting ability was done to all of the participants to verify the effect of training onto dependent measures.

Table 1: Means and mean differences in Bilateral Shooting Ability observed amongst the soccer players.

Groups	Bilateral Shooting Scores (Numbers)	
	Pre-intervention	Post-intervention
Control	84	88
Sc Biofeedback	79	95
EMG Biofeedback	86	97
Mean Difference	-----	**(p < 0.01)

RESULTS AND DISCUSSION: Table 1 above reveals descriptive information as well as differences existent between groups across the measurements obtained in different phases of intervention. Based on the results represented, it could be stated that the findings of the pre-intervention analyses revealed no pre-existing differences, and hence alterations observed during the post-intervention analyses rationally could be attributed to the differential modes of biofeedback interventions introduced to the participants of the experimental groups [2].

Table 2: Model *a* - Summary of multiple linear regression analysis (who received Sc biofeedback training).

Model *a* Dependent Variable – Bilateral Shooting ability	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.467	.115		-4.071	.000
Autonomic Latency	.197	.058	.268	3.401	.001***
Recovery	-.215	.055	-.332	-3.909	.000***

In Table 2, the model *a* emerged significant as the psychobiological measures such as latency and amplitude could explain 43.5% variance of changes in the extent of shooting ability observed in the players. Model *a* however explained direct relationship between latency and inhibitive impact of recovery on shooting ability revealing that delayed latency and faster recovery could facilitate in better shooting ability. Model *b* (Table 3) explained 54.9% of variances, in which direct relationship between amplitude and inhibitive impact of autonomic recovery on shooting ability were evident, which revealed that larger amplitude and faster recovery could facilitate in better shooting ability. Findings of regression analyses however revealed the role of autonomic orienting reflex in facilitating better shooting ability [1].

Table 3: Model *b* - Summary of multiple linear regression analysis (who received EMG biofeedback training).

Model *b* Dependent Variable – Bilateral Shooting ability	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	-.786	.142		-5.535	.000
Amplitude	.432	.084	.268	5.143	.001***
Recovery	-.351	.067	-.332	-5.239	.000***

CONCLUSION: Outcomes however suggested that both of the interventions facilitated in improvements in reaction ability, while in-depth contribution of autonomic components were evident.

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PUTTING STROKE IN GOLF: KINEMATIC PARAMETERS AMONG AMATEUR GOLFERS

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INTRODUCTION: Putting is an important aspect in any golfers' game. Putting has always been associated with a kind of 'special feel' that golfers sense while performing the act [1, 2]. However the special feel is quite abstract and difficult to be measured. Previous study shows that the putting distance can be influenced by many factors, which includes, but is not limited to, skill, kinematics, shaft and club head characteristics [3]. This study focuses on observing the putting kinematics properties among Malaysian amateur golfers. Results from this study were then compared to a similar type of studies that has been conducted in Europe.

METHODS: Thirty local amateur golfers (n=30), aged between 20 to 50 years old were selected in this study. Putting stroke from each subject were recorded using one high definition camera with 50 frame per seconds from subject's anterior plane as shown in Fig. 1. The recorded videos were then analysed in Kinovea Motion Analysis Software (v0.8.15) as shown in Fig. 2. Joint positions and displacements were tracked by the motion analysis software. Selected kinematic parameters are stance width, sternum - floor height, sternum –ball position and ratio of stance width with sternum- floor height. Results obtained from Kinovea measurement are then analysed by SPSS package (v 16) for statistical analysis.
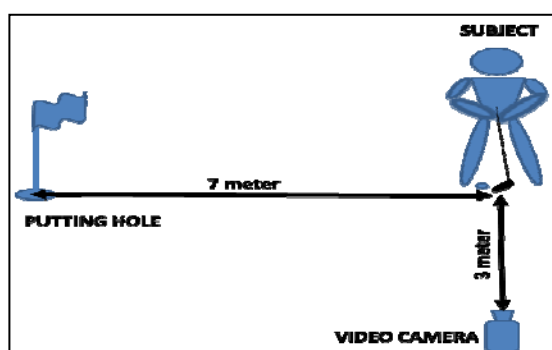
Figure 1: Research Setup.

Figure 2: Analysis with Kinovea.

RESULTS AND DISCUSSION: For the stance width, the recorded values ranged between 6 to 39 cm with mean of 24.73 cm. The values for sternum-floor height were 100 cm to 130 cm, with mean of 114cm. For the sternum-ball position, the minimum is 1.5 cm, with a maximum of 4.8 cm with mean values at 3.24 cm were recorded while the percentage ratio for stance width divided by sternum -floor height is 21.65%. The highest correlation between parameters that have been observed was the correlation between the sternum-ball position and stance width. There was no significant difference between the stance width and sternum-floor height although both have a weak positive correlation. The sternum-floor height and sternum-ball position parameters showed no significant difference as well. Overall results indicated that subjects that participated in this study have achieved similar results which were conducted on golfers from Europe in a separate study [1].

CONCLUSION: The 'special feeling' that golfers sense when performing a shot should be linked with kinematics parameters. This study indicated that Malaysian amateur golfers' kinematics properties are comparable and possessed similarity with European golfers. Continuous monitoring on the technical aspects of putting is important to ensure progression in skills acquisition and development.

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MECHANOMYOGRAPHY BASED MUSCLE MOVEMENT ANALYSIS: A BRIEF REVIEW

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INTRODUCTION: Researchers have explored to establish suitable method to investigate muscle movement activities, which include electromyogram (EMG), myokinetic therapy, sonomyogram, tensiomyogram and mechanomyogram. Although EMG is widely used in muscle assessment but it has some limitations. Surface electromyogram (sEMG) is very sensitive to external noise and interference which restrict its operating environment and range of its applications. Furthermore, it is an expensive and complex procedure in signal processing. Conversely, researchers introduced MMG as another tool to study muscle mechanical activity. The mechanomyography is a technique by which detect the mechanical activities of muscle with the aid of specific transducers to record muscle oscillations due to mechanical activities of motor unit. MMG signal can be identified using several types of transducers such as piezoelectric contract sensors, microphones, accelerometer and laser distance sensors. There are many examples where MMG is used to characterise muscle activity such as muscle function assessment (fatigue, muscle movement etc.), motor unit activity, study of muscle evaluation during sports. The purpose of this review is to determine the current status on MMG based muscle movement analysis as well as identifying potential area(s) for future research.

METHODS: A systematic search was performed on all published articles in the IEEE, PubMed, Springer, Elsevier and Wiley online Library and related muscle movement assessment papers were then selected. After subsequent evaluation, six papers were extracted to meet our objective.

RESULTS AND DISCUSSION: Six studies that examined muscle movement activities were selected [1-6]. Scheeren et.al. examined the functional movement of rectus femoris (RF) and vastus lateralis (VL) muscles by MMG during different functional electrical stimulation profile [1]. The authors reported that the lowest root mean square values of MMG and the spectral median frequency (MF) were verified within the 200-50 FES profile, suggesting that less muscle modification occurred during the experiment. Krueger et.al. defined the correlation between MMG signal and passive movement of healthy and spinal cord injured (SCI) patients [2]. It was reported that there was a positive correlation for healthy subjects and a negative correlation for SCI patients. Tian et.al. observed different sEMG and MMG behaviours accompanied with age related sarcopenia for young and elder grouped collected from VL muscle during concentric contraction with movement intensities of 45%, 60% and 75% [3]. The authors suggest that MMG is a useful tool in studying muscle contraction in age related sarcopenia. Yoshimi et.al. developed a new system to examine muscle activities and mandibular movement patterns during sleep bruxism [4]. The authors concluded that tapping clenching and grinding movements of mandible could be effectively differentiated by a new system. Kawakami et. al. determined sEMG and MMG signal in the lateral Pterygoid muscle during mandibular movement for maximum voluntary clenching [5]. They showed that the activity of the lateral Pterygoid muscle could be evaluated by means of MMG signal. Whilst, Scheeren et.al. characterised wrist movements like elbow extension and flexion, ulnar deviation and radial deviation [6]. Their statistical analysis indicated that there was no similarity between the flexion, extension, as well as ulnar and radial deviation.

CONCLUSION: This review summarised the findings of the employment of MMG in quantifying muscle movements. It provides adequate evidence that MMG may be used to determined muscle action due to movement.

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MUSCLE SYNERGY IS ROBUST ACROSS DIFFERENT PHYSIOLOGICAL DEMANDS DURING ROWING

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INTRODUCTION: Muscle synergy was defined as a specific and consistent spatiotemporal pattern of muscle activations that led to similar joint trajectories and was proposed as a neural strategy for simplifying the neuromuscular control. These synergies were identified from electromyographic (EMG) patterns recorded from numerous muscle decomposition algorithms (e.g. Principal Component Analysis, PCA). The study of muscle synergy and its association to energy capacity is crucial for rowing as huge percentage of total muscle mass are recruited during high intensity exercise. Due to the close link between the state of energy supply and types of muscle fibers being recruited, the muscle synergy was hypothesized to enhance rowing economy. Besides, the robustness of muscle synergy was extensively studied across tasks, mechanical constraints, training effect, and posture, but the robustness of muscle synergy across different physiological demands remains an open question. Therefore, this body of work was designed to fulfill the gap in muscle synergy literature.

METHODS: Six minutes maximal rowing test, Wingate rowing anaerobic test and incremental rowing VO2 max test were conducted on slides ergometer for 10 collegiate rowers and 10 physically active untrained subjects. Wingate anaerobic test was an assessment of anaerobic power and VO2 max test was applied to evaluate aerobic capacity. As a power endurance sport, both energy pathways (i.e. aerobic and anaerobic) were crucial for maximum rowing performance. The six minutes maximal rowing test was a simulation of a typical rowing event where the interplay of all energy pathways was highlighted. Muscle synergy was extracted from 16 rowing specific muscles using PCA with varimax rotation [1]. Parallel Analysis (PA) and Minimum Average Partial (MAP) were computed to enhance the extraction method. Data from the surface electromyography, rowing performance, and energy metabolism were collected and analyzed. Appropriate statistical tests were applied to study the association of muscle synergy and rowing economy.

RESULTS AND DISCUSSION: Three muscle synergies were sufficient to explain the majority of variance for both groups across three rowing tests (e.g. Wingate rowing anaerobic test, incremental rowing VO2 max test, six minutes maximal rowing test). Overall, for both groups, Synergy #1 was activated during the first half of the drive phase, Synergy #2 was engaged during the second half of the drive phase and Synergy #3 was predominant during the transition of strokes positions (e.g. from recovery to catch). Synergy #1 always gained largest contribution from the leg, back and chest muscles, Synergy #2 was typically consisted of upper limb muscles and Synergy #3 comprised of Rectus Abdominis (AB), Rectus Femoris (RF) and Tibialis Anterior (TA) with minor variations in different experimental tests. The statistical analysis showed that Synergy #1 which comprised about half of total variance accounted for all synergies was highly correlated to rowing economy. The rowers preferred to row slower with longer strokes compared to the untrained subjects [2]. This strategy indicated practice-related adaptation that was suggested to reduce energy cost [3]. Due to this rowing technique, the rowers were able to exert powerful rowing strokes with better rowing economy compared to the untrained subjects in any tests.

CONCLUSION: Based on these results, we showed that the muscle synergy was robust across different physiological demands. The findings of this study could guide the rowers and their coaches to enhance the training regime. As rowers have to sustain high aerobic intensity during a rowing event, they could apply our findings by focusing the training on the muscle synergies refinement, which will improve their rowing economy.

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ACUTE EFFECT OF STANDARDIZED LOAD RESISTANCE TRAINING ON CARDIO-RESPIRATORY RESPONSES IN RECREATIONALLY ACTIVE PARTICIPANTS

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INTRODUCTION: The aim of this study is to determine acute responses of standardized resistance training load, on cardio-respiratory variables in recreationally active participants.

METHODS: Twelve recreationally active male (age 23.5 (± 4.07) years, mass 70.5 (± 7.84 kg), height 1.69 (± 0.06) m, body mass index 24.8 (± 2.14) kg/m^2) participated in this study. Participants performed an exercise protocol comprised of 6 exercises at a standardized load. Each exercise was performed with a duration of 60 seconds with uncontrolled lifting velocity. Cardio-respiratory responses were measured using a portable metabolic system analyzer during the exercises and a wrist digital blood pressure monitor to determine pre- and post-protocol blood pressure responses..

RESULTS AND DISCUSSION: Pre-and post-protocol systolic (p=0.744) and diastolic (p=0.758) blood pressure indicates no significant responses. However, significant differences were observed in pre- and post-heart rate response (p=0.000). Peak cardio-respiratory responses recorded during the protocol were 30.2 (± 4.02) ml/Kg/min for oxygen consumption, 138 (± 61.9) bpm for heart rate, and 633 (± 71.2) kcal for energy expenditure. On average, Metabolic Equivalent of Task (MET) recorded was 8.62 (± 1.19). For a short duration standardized load circuit training exercise protocol, cardio respiratory responses recorded are similar to comparable other protocols. Metabolic cost of exercises was nearly half of the recommended energy expenditure through exercise per week.

CONCLUSION: The prescribed protocol seemed to be comparable with other similar exercise protocols for cardio-respiratory variables, however more efficient in terms of caloric expenditure whilst being perceived less strenuous over a similar exercise duration [1-3]. However, longitudinal adaptations may differ from one person to another if the protocol is used for a prolonged period in training, especially by highly trained participants. Further longitudinal investigations thus suggested. Based on present data, practically the prescribed protocol is applicable and beneficial for active healthy individuals.

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THE EFFECTS OF FARTLEK TRAINING IN IMPROVING CARDIORESPIRATORY FITNESS AMONG ELDERLY

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INTRODUCTION: Fartlek is one of the principles of the Low Intensity Exercise Endurance adopted by athletes especially in long distance events [1]. Fartlek exercise is an important training method in assisting the development of athlete's aerobic and anaerobic capacities [2]. However, the usage and effects of fartlek training is still vague amongst the elderly. This paper aims at evaluating the effectiveness of fartlek in improving cardiorespiratory fitness among the elderly.

METHODS: A total of 15 subjects ranging from the age of 50 to 60 were involved in this study. The intervention program were implemented for 6 weeks, twice a week, and 1 hour per session. YMCA 3-minute step test were used to measure the respondent's level of cardiorespiratory fitness. The collected data were analysed statistically through T-test analysis to find out the significant differences

RESULTS AND DISCUSSION: The results show that the effectiveness of fartlek exercise on the cardiorespiratory fitness can be identified as a feasible type of low-intensity exercise for the elderly. The findings from this study shows that there were significant statistical differences between the treatment group and the control group with respect to the cardiorespiratory fitness state of the elders. The findings suggests that the need to determine the significance of fartlek for patients in specific training settings namely, walking pace (speed) and the slope of the path in fartlek that may play a key role in implementing interventions for specific health outcomes.

CONCLUSION: The results of this study offers preliminary insights into the effects of fartlek exercise and to serve as a weekly workout routine for elderly Malaysians. Previous study suggests that fartlek exercise significantly improves the resting pulse rate or the resting respiratory rate [3]. Hence, this study reveals positive effects of the fartlek exercise in cardiorespiratory fitness and is likely to have an impact on other components of physical fitness. In future, it is recommended to test the fartlek exercise on muscle strength and muscle endurance of the lower limb.

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EXERCISE TRACKING USING HEART RATE VARIABILITY (HRV)

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INTRODUCTION: This work examines the influence of exercise on heart rate variability (HRV) in human subject. People carry out physical activity to stay healthy and fit. However, currently there is no systematic tool to track the progress of an exercise in term of its effectiveness and suitable level of activities. The cardiovascular system is mostly controlled by autonomic regulation through the activity of sympathetic and parasympathetic pathways of the autonomic nervous system (ANS) which can be determined from ECG recordings. Changes in balance of sympathetic or parasympathetic control of heart rate will result in measurable changes in HRV. HRV has been known since the publication of studies established that HRV can predict mortality after myocardial infarction (MI). In this work, short term HRV measurement was used due to more experience and theoretical knowledge exists on the physiological interpretation of the frequency domain [1]. Sympathetic mediators appear to reflect in the low frequency power (LF) of the HRV spectrum. Mean while, parasympathetic mediators principally affect the high frequency power (HF) of the HRV spectrum [1, 2]. This work uses a standard HRV analysis and suggesting that during exercise the power of LF is more than the HF.

METHODS: This work utilizes 10 short term ECG recordings in rest and exercise mode for 2 months period. The rest mode ECG was collected when subject was sitting and for the exercise mode, the ECG was collected 3 minutes after the subject completed a jogging activity for about 2.3 kilometres. The HRV is analyzed using fast Fourier transform (FFT), by transformed the individual R-R intervals stored in the computer into bands with different spectral frequencies. The regions of each power spectrum for short term recordings is commonly divided into three frequency bands [3]: very low frequency (VLF) band at 0.0033 Hz – 0.04 Hz, low frequency (LF) and high frequency (HF) band. The ratio of LF to HF (LF/HF) usually used in order to represent the controlled and balanced behaviour of the two branches of the ANS. For short term recording, VLF is dubious measures and was not considered in this study.

RESULTS AND DISCUSSION: Table 1 shows the results of power spectrum in 3 frequency bands ranging from 0 Hz to 0.4 Hz. Fig. 1 shows the HRV spectrum of data *Rest 1* which is calculated by FFT. It is clearly seen that power spectrum has more focus in low frequency (LF) band than in high frequency (HF) band. It is because the dynamic exercise is mediated by a biphasic mechanism initially depending on rapid vagal release and an increased of sympathetic activity, especially at higher levels of exercising. This is inline with the work by [4], where at the onset of exercise, heart rate is increased by a reduction in parasympathetic activity and a temporary increase in sympathetic tone. The total variance of the spectrum during rest was slightly higher than at exercise, with more 50%. Expressed in normalized units, the LF component becomes dominant during exercise which was synchronised with the LF/HF ratio, where it was slightly increased from rest to exercise which also shows the reflection of sympathetic dominance.

Variable	Data			
	Rest 1	Exercise 1	Rest 2	Exercise 2
Mean HR (1/min)	73.1	119.71	71.4	118.75
Power (ms^2)				
VLF (0-0.04 Hz)	6966	2413	1106	52
LF (0.04-0.15 Hz)	347	421	105	18
HF (0.15-0.4 Hz)	819	123	313	1
LF/HF	0.424	3.416	0.334	15.438
Power (n.u)				
LF (0.04-0.15 Hz)	29.7	77.2	25	93.9
HF (0.15-0.4 Hz)	70.1	22.6	74.9	6.1

Table 1: HRV analysis result.
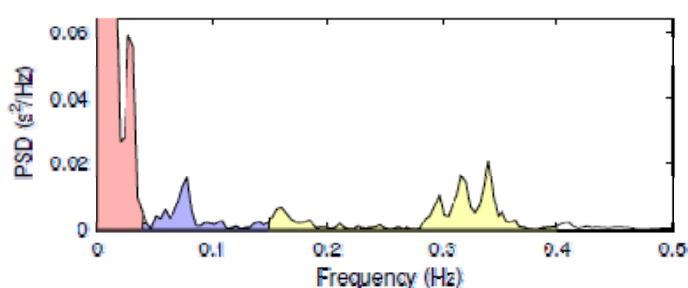
Figure 1: HRV spectrum of data *Rest 1* calculated by FFT.

CONCLUSION: A systematic tool to track the progress of an exercise using HRV is developed. HRV has shown a great potential to be used to track exercise progress and indicate the level of fitness.

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ANY WARM-UP PROCEDURES DO NOT AFFECT SUB-MAXIMAL RUNNING PERFORMANCE

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INTRODUCTION: Warm-up exercise (W-up) enhances performance for sprint time, jump height and time to exhaustion in maximal endurance exercise [1]. Usually, athletes carry out stretching at W-up procedures, but some studies report that stretching may impair the exercise performance [2]. These studies investigated stretching and jump, sprint or resistance exercise [3]. However, few studies have investigated effect of W-up and stretching on sub-maximal exercise performance. To clarify appropriate W-up procedure before the sub-maximal running, this study investigated the effect of different W-up procedures (W-up and/or stretching) on $90\%v\dot{V}O_2max$ running exercise performance. The submaximal running speed, i.e. the intensity, was based on track races of 3000 m to 5000 m. We hypothesize that the submaximal running performance would be improved by the W-up, and it would be impaired by without W-up or only stretching.

METHODS: Seven well-trained male university middle or long distance running athletes (age: 21.0+/-2.2 years, height: 170.3 +/- 3.8 cm, weight: 60.0 +/- 5.5 kg, $\dot{V}O_2max$: 72.3 +/- 3.7 ml/kg/min) took part in this study. Each subject continued a treadmill running at $90\%v\dot{V}O_2max$ until exhaustion (RUN-test) after one of four W-up procedures. The four W-up procedures were 1) no W-up (N), 2) 15 minutes running at $70\%v\dot{V}O_2max$ (W), 3) five static stretching of the lower extremities (S) and 4) 15 minutes running at $70\%v\dot{V}O_2max$ plus five static stretching of the lower extremities (W+S). Cross over design and random relocation was applied to the order of W-ups for each subject. The RUN-tests were performed on separate days with at least a two-day rest interval. We did not restrict the daily training or activity of the subjects, although the subjects were instructed not to perform strenuous exercise, not to consume alcohol for a period of 24 hours before each test, and not to eat for a period of 2 hours before each test. To exclude the influence of circadian rhythm, each examinee performed the tests at identical times. The room in which the tests were performed was maintained at a temperature of 20 to 24 $^{\circ}$C. We encouraged the subjects verbally during all the RUN-tests, until they could not continue running. The running performance was evaluated by time to exhaustion (TTE). Respired gases were analyzed by a VO2000 (S&ME, Japan). $\dot{V}O_2$ was continuously measured approximately every ten seconds by mixing chamber methods during the experiment (five minutes before W-up to end of the exercise). We used of 30-second-averaged data for analysis. Blood samples were collected before the W-up, immediately before and after the RUN-test to examine blood lactate accumulation. Blood lactate accumulation was examined by Lactate-Pro (LT-1710, Arkray, Japan). The temperature of the vastus lateralis muscle was measured by a surface type deep body thermometer (Core temp CTM-210, Telmo, Japan) before the W-up and immediately before the RUN-test.

RESULTS AND DISCUSSION: In the results, there were no significant differences in the TTEs among the W-up exercises (N: 788.1 +/- 200.6 sec., W: 819.3 +/- 230.6 sec., S: 792.0 +/- 281.2 sec., and W+S: 817.9 +/- 213.7 sec.). The peak $\dot{V}O_2$ during RUN-test did not differ between conditions. There were no significant differences among blood lactate accumulations at the any timing. The vastus lateralis temperature was lower in N and S than W and W+S immediately before RUN-test ($p < 0.01$, respectively). These results suggest that sub-maximal running performance is not affected with or without a W-up or by W-up procedures despite body temperature were different. It is thus reasonable to suppose that other conditioning factors (e.g., training or recovery) than W-up may be important for improving the sub-maximal running performance. Previous study suggested that W-up under LT intensity is not sufficient to improve maximal exercise performance [4]. In this study, blood lactate was not changed by W-up. Therefore, harder W-up than this study may change exercise performance.

CONCLUSION: The result of this study suggested that the running performance at $90\%v\dot{V}O_2max$ (to assume 3000m to 5000m race in track) did not differ with or without W-up. The running performance at $90\%v\dot{V}O_2max$ did not differ by W-up and/or stretching. The findings suggested that training and/or other conditioning factors must be important in improving submaximal endurance performance.

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BADMINTON: SPECIFIC MOVEMENT AGILITY TESTING SYSTEM

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INTRODUCTION: Agility is an important quality in many sports played on court or field. In badminton, agility indicates the ability to move to the approaching shuttle with a correct footwork. There are several agility performance tests that have been developed according to the nature of the different sports namely rugby, netball and football which focuses on the change of direction speed and perceptual/decision making [1-3]. However, specific agility testing for badminton currently available only focuses on the change of direction speed with all tests forgoing the perceptual/decision making aspect [4]. Therefore, the purpose of this study is to present a new methodology for measuring specific movement agility in badminton. Additionally, a second purpose of the research is to investigate if there were differences of agility performance (changes of direction speed and decision time) between pre-planned agility (sequence movement) test and specific movement agility (randomly movement) test using previously developed system i.e. Badminton Agility Training and Testing System.

METHODS: Specifically, the agility performance of male players (n=40) when responding to interactive LED lights (Fig. 1) showing the direction shot (randomly) from opponent, was compared to a traditional, pre-planned agility movement where no external stimulus (sequence) was present. Subjects were randomly selected among students enrolled in badminton as their curriculum course. The test was conducted after they have completed 14 weeks of the course. The total change of direction speed of the players was the primary dependent measures of interest.
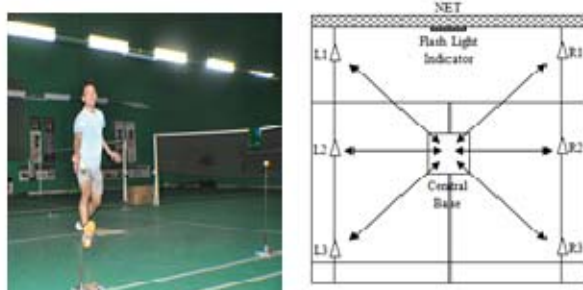
Figure 1: Agility Training and Testing System.

RESULTS AND DISCUSSION: The results showed that significant differences existed between the two test conditions proving that the system was assessing different types of agility. The pre-planned agility (sequence) was found to be faster compared to the specific movement agility test (random) with significant difference ($P < 0.05$) between the mean results (25.63 ± 1.94 s and 31.66 ± 1.66 s). This difference was found to be caused by the presence of decision making (decision time) in the specific movement agility test [5].

CONCLUSION: Therefore, the results suggest that badminton-specific movement agility test system is a better measure of badminton specific agility performance than an equivalent non-specific pre-planned agility test since the nature of the game of badminton requires change of direction speed and decision making. Future research may include elite badminton players to further assess the device's capability.

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THE ACCURACY OF THE SPORTS TALENT IDENTIFICATION DECISION SUPPORT SYSTEM FOR YOUNG ATHLETES

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INTRODUCTION: Success in the international sports arena is a priority to each of the competing countries. Therefore, each country would prepare their athletes to compete, starting at a very early stage, which is necessary to pursue success. Due to systematic and scientific sports talent identification programs (TID), many countries such as Australia [1], China [2], Eastern Europe [3], Germany [4] and Russia[5] had done well in the sports arena. Documented results showed positive effects on achievement among the countries that had implemented this program. The use of technology in talent identification has been recognized as a way to smoothen the process of sports talent identification program. Currently, the implementation of TID in Malaysia focuses only on physical abilities, sports specific skills, and level of mental toughness. The data were not processed manually to determine the ability of a young talent. Therefore, the study developed a Sports Talent Identification Decision Support System (STIDSS) that combines four attributes namely; physical, physiological, psychological, and sociological traits to overcome this limitation. Therefore, the aim of this paper is to measure the accuracy of using the talent identification decision support system for Malaysian junior athletes.

METHODS: 13-year old male and female athletes (n=75) from the Malaysian Sports School (Tunku Mahkota Ismail) and Johor State Sports School (SMK Tun Hussin Onn) were involved in this study. The subjects were selected from three categories of sports: 1) ball games (football, hockey, netball, rugby, volleyball); 2) racket sports (badminton, tennis and squash); and 3) precision sports (archery, tenpin bowling). Test scores of the four attributes were analyzed using the STIDSS and the category of sports for each individual was determined. The accuracy of the STIDSS was analysed using descriptive statistics to calculate the frequency and the results were presented in percentage value.

RESULTS AND DISCUSSION: The output from the system was then compared to the actual sport of the individual athlete. The results illustrated in Fig. 1 shows that out of the 75 subjects, a total of 57 subjects' output matched their actual category of sport. This suggests that the system was 76% accurate in determining the category of sport. Thus, the use of Sports Talent Identification Decision Support System is proven to be suitable in the process of decision making to match young talent to specific sports based on an evaluation of physical, physiological, psychological and sociological characteristics.
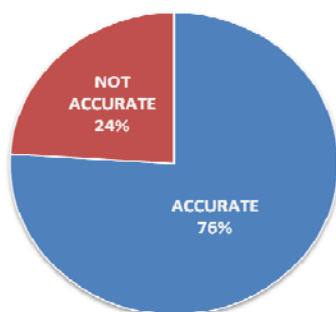
Figure 1: The accuracy of the STIDSS

CONCLUSIONS: STIDSS is a system that can assist the TID program in the future. Essentially, future research will include a wider variety of categories of sports to provide a more efficient system.

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BODY COMPOSITION CHANGES IN RESPONSE TO COMBINATION OF RESISTANCE AND AEROBIC ENDURANCE TRAINING.

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INTRODUCTION: The purpose of this study is to evaluate the effect on combination of resistance and aerobic endurance training in reducing body fat. Normally, fat reduction program been associated with aerobic endurance training only since fat oxidation pathway respond to aerobic condition (sufficient oxygen supply).

METHODS: Thirteen male respondents involved in this study (Age=30.16±4.25, BMI=32.86±4.89). Respondents that been choose in this study had no serious illness and joint problem to make sure they can complete the training module. Each respondent are required to declare their health and fitness status using Par-Q and You form before participate in this study. Respondents were divided into two groups based on training module (group A= Combination of resistance and aerobic endurance training and group B= aerobic endurance training). For aerobic endurance training, respondents had undergone circuit training that consists of running on treadmill, cycle ergometer and body weight exercise. The intensity was maintained at 70% to 85% of maximum heart rate. For resistance training, complete body workout with mild intensity (55%-70% of maximum strength) was applied. Respondents were trained for 8 weeks and body composition analysis was done prior to the beginning and every two weeks. Data were taken using InBody 230 Body Composition Analyzer.

RESULTS AND DISCUSSION: One Way Repeated Measure ANNOVA analysis show that there was no significant different between individual within the same group (Table 1). Paired samples t-test analysis was done to compare changes between both groups. Only FFM changes give significant different between both groups where Group A had significantly higher FFM increments compared to Group B. Group A had increments in muscle mass changes (mean=10.0258) while Group B had decreases, lower than the mean of the starting value (mean=10). Eexercise that normally been related to fat reduction is aerobic exercise. Fat was stored in the form of triglyceride as energy reserved in the body [3]. Fat oxidation capacities increase from low to moderate intensity physical activity and decrease from moderate to high intensity activity [1]. Resistance training associate with the carbohydrate energy pathway since its produce fast energy to compensate with high and fast energy need during exercise. Carbohydrate was stored as glycogen at the liver and its metabolism pathway is much faster compared to fat oxidation process [2]. Even though resistance training will used most of the glycogen and glucose as their energy source during exercise, there are studies that suggest resistance training will prolong and elevate post-exercise fat oxidation and resting metabolic rate. This suggest that resistance training also play important role in reducing body fat mass [4].

Table 1: Body composition value

	Group A					Group B				
	Pre-test	Week 2	Week 4	Week 6	Week 8	Pre-test	Week 2	Week 4	Week 6	Week 8
Body Weight (kg)	86.33±7.9	85.83±8.1	85.76±8.2	85.49±7.9	85.71±8.6	104.83±21.6	103.52±21.3	103.45±21.6	102.78±21.3	99.46±21.7
Fat (kg)	28.84±4.5	27.98±3.8	27.49±4.0	28.09±3.0	27.2±3.8	38.58±6.5	38.23±6.5	38.25±6.7	37.53±6.7	37.98±6.9
Muscle (kg)	32.56±3.0	31.57±2.4	33.01±3.2	32.46±3.3	32.78±3.6	37.21±11.7	36.48±12.7	36.37±14	36.85±12.4	32.84±13.2
FFM (kg)	57.49±5.1	55.85±4.1	58.27±5.6	57.4±5.7	57.93±6.2	67.62±10.8	67.03±10.8	67.08±11.1	65.93±11.1	66.62±11.5
BMI (kg/m^2)	30.96±1.0	30.67±1.0	30.84±1.0	30.6±0.8	30.48±0.8	34.87±7.2	34.5±7.0	34.5±7.3	34.27±7.2	32.8±7.1

Data was expressed as Mean ± SD

CONCLUSION: Combination of mild intensity resistance and aerobic endurance training had better effect in reducing body fat mass compared to aerobic endurance training alone since it can increase FFM and prevent muscle loss.

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A COMPARISON OF PHYSICAL FITNESS, ATHLETIC PERFORMANCE AND COMPETITIVE ACHIEVEMENTS BETWEEN JUNIOR AND ADULT TENNIS PLAYERS

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INTRODUCTION: The Japan Tennis Association has established the Tennis Field Test aiming at developing effective coaching methods to improve competitive achievements in individual elite tennis players. An evaluation performed by this test allows the results obtained from different players and conditions (e.g. generations, gender and court surface) to be compared. On the basis of such evaluation, an effective coaching method could be developed specifically for each individual tennis players. Thus, it appears that successful coaching appropriate to growth and development among players in different generations is one of target areas to be provided by the use of this test. This study was aimed at evaluating physical fitness and athletic performance by the use of the Tennis Field Test in comparison with two different age groups and competitive achievements.

METHODS: The total number of 48 tennis players, 24 junior players including regional representatives and 24 adult players including national representatives was investigated. Further, those players were classified either the average or the superior group on the basis of competitive achievements in the national tournament performance. All subjects participated the Tennis Field Test that consists of 5 testing items, the number of times of sit up, the distance of the standing long jump, the time elapsed for the spider run (an index for agility), the shuttle run and the distance for 3 minute run (an index for whole-body endurance capacity) .

RESULTS AND DISCUSSION: In the junior tennis players, the superior group performed faster in the spider run as compared to the average group ($p<0.01$). In the adult tennis players, the superior group showed a longer distance for 3-minute run as compared to the average group ($p<0.05$). No significant difference was obtained in other testing results. Agility influence the most on the competitive level of young tennis players [1]. The increase in strength, size, and endurance typically occur in boys between the ages of around 12 to 15 years [2]. As tennis players mature, it seems that the major factors affecting their performance alters [3]. These results indicate that agility performance is a strong component to predict success for junior tennis players, while whole-body endurance performance is a key component for adult tennis players.

CONCLUSION: This study suggests that the competitive achievements are reflected by the agility in the junior tennis players, while, in the adult tennis players it was reflected by the whole-body endurance capacity.

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MUSCULAR STRENGTH AFTER 12 SETS OF HIGH INTENSITY LEG EXTENSION EXERCISE RECOVERS WITHIN 2 DAYS

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INTRODUCTION: The frequency of resistance training is recommended 2 or 3 days per week [1]. The appropriate frequency may be related to recovery time of muscular strength after resistance exercise. Thus, when we perform high volume resistance exercise, the days necessary for recovery of the muscular strength would extend. Nosaka et al. [2] showed the group which performed 24 repetitions of eccentric exercise decreased maximal voluntary contractile force after several days in comparison with the group which performed 12 repetitions. Therefore, the appropriate frequency may be different according to training volume performed in 1 session. However, recovery time after high volume resistance exercise is not clear. Therefore, the purpose of the present study was to investigate the muscular strength after high volume leg extension exercise. We hypothesized that the recovery days after 12 sets of resistance exercise would be longer than that of 6 sets.

METHODS: 16 healthy men university students participated in this study. They were randomly divided into 12 sets group (12SET, n = 8, 21.0 +/- 1.7 years, 173.4+/-4.7 cm, 64.2 +/- 5.6 kg) and 6 sets group (6SET, n = 8, 19.9 +/- 1.1 years, 170.9 +/- 7.4 cm, 67.2 +/- 9.6 kg). Beforehand, 1 Repetition Maximum (RM) of leg extension exercise in right leg was assessed to determine each subject's exercise intensity. They performed leg extension exercise in right leg on the first day. Exercise intensity was set at 90% 1 RM in 1st set. From 2nd set, the weight was adjusted as to become 4-6 RM. The rest between sets was 3 minutes. Maximal voluntary contractile (MVC) torque and isokinetic strength (30 deg / sec, 60 deg /sec, 150 deg / sec, 240 deg / sec) were measured with KIN-COM® dynamometer (Chattecx, Inc., USA) before (PRE), immediately after (POST), and for 7 days after exercise. When measuring MVC, subjects were instructed to extend the right knee joint with maximal effort for 3 seconds. The peak tension over 3 seconds was taken as the MVC torque. This was measured 2 times with a rest period of 1 minute. The higher torque value of the 2 trials was taken as the MVC. When measuring isokinetic strength, torque at each angular velocity was measured 2 times. The higher torque value of the 2 trials was taken as the isokinetic strength of each angular velocity. To exclude the influence of circadian rhythm, each subject performed the tests at identical times.

RESULTS AND DISCUSSION: There was no interaction effect in any measurements. Significant time effect was found in all measurements. MVC decreased after exercise (PRE: 302 +/- 64 N.m, POST: 261 +/- 33 N.m). No significant difference was seen in MVC between PRE and 1 day after exercise (289 +/- 42 N.m). Isokinetic strength at 30 deg / sec decreased 1 day after exercise (PRE: 284 +/- 50 N.m, 1 day after: 261 +/- 54 N.m). And no significant difference was observed between PRE and 2 days after exercise (262 +/- 57 N.m). Isokinetic strength at 240 deg / sec decreased POST (PRE: 150 +/- 25 N.m, POST: 134 +/- 25 N.m). And no significant difference was evident between PRE and 1 day after exercise (152 +/- 28 N.m). There were no significant changes in Isokinetic strength at 60 deg / sec and 150 deg / sec by post hoc test. The data in 2 days after exercise in all measurements were not different from PRE. These results suggest that MVC and isokinetic strength at each angular velocity after high volume leg extension exercise do not different between 12 sets and 6 sets. And muscular strength recovers within 2 days after high volume leg extension exercise even performed 12 sets.

CONCLUSION: The results of the present study did not support our hypothesis that the recovery days after 12 sets of resistance exercise would be longer than that of 6 sets. Muscular strength recovered by 2 days even if 12 sets of high intensity leg extension was performed.

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DEVELOPMENT OF A TRIMODAL PARADIGM FOR PERFORMANCE ENHANCEMENT IN RECURVE ARCHERY

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INTRODUCTION: Performance in recurve archery relies on physical determinants such as physical fitness, biometric profile and mental strength that encompasses specific neurocognitive variables including mental concentration, focus and the ability to perform under stress [1]. Although archery depends on individual performance with easily recordable objective outcomes, there is a need not only to determine the various underlying factors involved but also how each of these factors relate and contribute to the overall performance of an individual recurve archer [2]. A computerised programme using up-to-date technical capability to analyse relevant scientific data such as the trimodal paradigm would provide beneficial contributions in the analysis of individual archer's performance.

METHODS: This study involved identification and determination of relevant parameters, and data collection that included demographic data and archery history (questionnaire-based), anthropometric (measurement), biometric (KINOVEA®) [3], physical fitness (specific tests with time and vital sign monitoring) and neurocognitive (CANTAB®, QNST®) parameters [4]. Assessment of elite and novice recurve and compound archers that belonged to various state teams, institutions and local clubs participating in various archery activities were then carried out. With the advice and cooperation of experienced and well-trained coaches/and trainers, pertinent information was gathered, documented, computerised and appropriate statistical analysis done. A comprehensive profile of individual archers was developed on an Excel® platform and the relationship between the variables was graphically demonstrated. Subsequently, the programme was tested in various groups including an elite Kelantan state team member of recurve archers participating in Sukan Malaysia 2014. After data collection and performance analysis by the computerised programme, the derived feedback was then forwarded to the respective archers and their coaches where interventional processes were then carried out. The performance of these archers in national competitions were subsequently monitored.

RESULTS AND DISCUSSION: The large amount of data collected allowed for the creation of a comprehensive and relevant database of archers. The developed Excel® programme can be used interactively to view each individual profile and their relationship to his/her performance, identifying weaknesses and strengths in various physical and mental components that would significantly contribute to individual performance [5]. The programme was applied by the Kelantan state team during training and participation in national competitions with favourable outcomes.

CONCLUSION: The developed Excel® programme was successfully used in the diagnostic and interventional processes in recurve archery. It contributed significantly in formulating individual and group training modules for the enhancement of performance [6]. Not only did individual archers directly benefit from the programme, but coaches, trainers and sport administrators were also able to scientifically and objectively assess the archer profile and indirectly contribute to performance enhancement. Measurement of specific EEG parameters is ongoing and will be included in the profile. This dimension will be used to evaluate neurofeedback mechanisms in the self-instructional training/practice for enhancement of performance in archery.

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VISUAL REACTION TIME CHARACTERISTICS IN SCHOOL CHILDREN ATHLETES ATTENDING A NATIONAL SPORT SCHOOL

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INTRODUCTION: Athletes' performance and perceptual abilities have always been a topic of interest. Researchers believed that better understanding in visual reaction time (VRT) among athletes could unlock the key towards more successful sports performance [1]. Previous studies have shown that faster VRT was noted among athletes as compared with non-athletes [2,3]. VRT also varies between genders and previous studies have shown faster responses in males as compared to females athletes [4-6]. Brady also found that male athletes outperformed female athletes in magnitude and direction of errors [4]. Faster and more accurate responses were noted in VRT measurement as the age of an athlete increases [7]. However, little information is available on the VRT among Malaysian school children athletes. Hence, the purpose of this study was to investigate the charateristics of visual reaction time among school children athletes attending sports school.

METHODS: One hundred and eight subjects, school children athletes, aged between 13 to 16 years old (mean 14.86 ± 1.03 years) were selected. The study sample contained 57 (52.8%) males and 51 (47.2%) females, and comprised of 40.7% Malay, 47.2% Chinese and 10% Indian ethnicities. All the subjects selected were involved in various sports disciplines, with their sports involvement duration ranging from 1 to 13 years (mean 5.81 ± 2.67 years). Visual screening performed included refraction, stereopsis, colour vision and hand dominancy tests. VRT was measured in milliseconds (msec) using the simple visual reaction time (SRT), two multiple-choice visual reaction time (2CRT) and four multiple-choice visual reaction time (4CRT) tests, with a Lafayette Choice Reaction Time device (Model 63035).

RESULTS AND DISCUSSION: Results of the study showed that the mean for corrected monocular visual acuity (VA) of the right eye was 0.03 ± 0.06 logMAR and for the left eye was 0.02 ± 0.06 logMAR. All the subjects had good binocularity with a median stereo acuity of 60 seconds of arc (TNO test) and normal colour perception score of 24/24 (Ishihara test). Between genders, male subjects had faster SRT and 2CRT ($p > 0.05$). The differences between all VRT tests was [$F_{(2,105)} = 63.84$, $p < 0.01$], suggesting that subjects responses became slower as the number of visual stimuli increased. The VRT for male subjects was faster compared to females especially in younger subjects but it was not statistically significant. There was no statistically significant difference in VRT among the subject ethnicities though subjects of Chinese ethnicity were individually found to be fastest.

CONCLUSION: In conclusion, this study provides a data baseline for VRT among Malaysian school children athletes showing that the mean SRT, 2CRT and 4CRT became slower as the number of visual stimuli increased. Generally, male athletes were found to outperform female athletes with faster response, higher accuracy and less variability.

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EFFECT OF TRADITIONAL GAME OVER AGE EQUIVALENT LEVEL INCREASE LOCOMOTOR SKILLS, MANIPULATIVE AND THE GROSS MOTOR DEVELOPMENT AMONG CHILDREN IN EARLY STAGE SCHOOL IN FELDA

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INTRODUCTION: Studies on gross motor development was carried out for the proposed intervention program is associated with the movement behaviour that would be assessed. Nonetheless, this type of game is given less attention in the primary school curriculum. To date, no studies evaluating the effectiveness of the curriculum for gross motor development of children in the early primary school, although it is important for children to develop more specific skills [1-3]. The result of this study focuses on the knowledge and variations to the physical training practitioner in order to ensure that the development of gross motor skills of children are in line with the development of their chronological age.

METHODS: The study involves two phases: Phase (i), a study on the level of gross motor development, age equivalents locomotor and manipulative skills. This phase involves 192 students and it is important to get the basic data as well as determining the groups of children who need to be given intervention program. Phase (ii) a study of the effects of traditional games on the equivalent age of locomotor skills, manipulative and gross motor development involving 64 children [4]. This is a quasi-experimental period of 12 weeks involving pre and post test. Traditional game module is selected as physical training activities for the treatment group while the control group used normal PE module. Both groups were taught by the same teacher of PE option. Gross motor development data obtained from video recording consist of locomotor and manipulative skills by means of the Test of Gross Motor Development [5]

RESULTS AND DISCUSSION: The research questions involve two phases of the study: (i) descriptive analysis to determine the level of gross motor development and age equivalents and (ii) Multivariate analysis of variance (MANOVA) analysis. The findings of the first phase of the study subjects shows that Year Three students are delayed by 2.13 years in age equivalent scores locomotors (AEL) and age equivalent scores manipulative (AEM) of 2.62 years as compared to Year One and Year Two students . MANOVA analysis for the second phase revealed significant difference in the mean GMDQ for pretest [$F(3.60) = 3:39$; $p <0.05$, $R^2 = .145$] between control and treatment groups also found significant differences in the mean GMDQ for post-test [$F(3.60) = 40.28 : p <0.01$, $R^2 = .668$] . F univariate analysis showed significant differences for the three dependent variables during the post-test GMDQ [$F(1,62) = 116.16$; $p <0.001$, $R^2 = .65$], AEL [$F(1,62) = 36.53$; $p < 0.001$, $R^2 = .37$] , and AEM [$F(1,62) = 48.76 : p <0.001$, $R^2 = .44$] .

CONCLUSION: The results of the analysis suggests that intervention programs that use proven traditional games can help improve the gross motor development of children.

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MANAGEMENT INFORMATION SYSTEM IN ENHANCING SENIOR CITIZENS TOTAL WELLNESS

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INTRODUCTION: Wellness of senior citizens is becoming more important as this age group increases in size In Malaysia currently has about three million senior citizens and the number is rising. According to [1], the population aged 65 and over is projected to increase more than three-fold of the 2010 population and this will lead Malaysia to become an aging population in 2021. The term wellness has been applied in many ways. Although there might be different views on what wellness encompasses, the National Wellness Institute along with the help of leaders in health and wellness agreed that wellness is multidimensional and holistic, encompassing lifestyle, mental and spiritual well-being, and the environment. However, the definition of wellness, long used by the National Wellness Institute is consistent with these tenets which is wellness is an active process through which people become aware of and make choices toward a more successful existence [2]. Recently, current studies on wellness only focus on citizens in general and the physical health aspect [3]. Besides that, present studies only assessed total wellness using manual inventory [4]. However, this study focused on the overall wellness for senior citizens based on the Six-Dimensional Model of Wellness proposed by Bill Hettler, co-founder and president of the board of directors of the National Wellness Institute. The model consists of emotional wellness, intellectual wellness, occupational wellness, physical wellness, social wellness and spiritual wellness [2]. Furthermore, this study applied the use of Management Information System (MIS) in assessing senior citizens' total wellness. Therefore, the purpose of this paper is to examine how the management information system can enhance senior citizens' total wellness.

METHODS: This is a multi-discipline research where fundamentals of health science, social science and computer science were combined. Integration of those elements will assist in developing a management information system. The development of system will comprise elements of total wellness. In order to determine the accurate elements of total wellness that suit senior citizens, the researcher employs a needs analysis which uses a combination of quantitative and qualitative approach. The researcher distributed questionnaires (k=0.96, r=0.90) to 50 senior citizens to obtain quantitative data while five experts were interviewed so that qualitative data could be attained.

RESULTS AND DISCUSSION: From the 50 questionnaires distributed, only 42 were fully completed. 3 respondents did not return their questionnaires while5 questionnaires were not completed. From the result, it can be concluded that majority of respondents lack understanding regarding total wellness and agreed that this approach being adopted in senior citizens after being brief by the researcher. The findings from the survey were supported by interview response where the experts recognized the importance of total wellness approach and highly recommended that this approach being applied in senior citizens. From the six elements of wellness, only five elements being short listed including physical, emotional, intellectual, social and spiritual. Those elements were selected according to their suitability. The finding also revealed that MIS is relevant to be implement in assessing senior citizens total wellness.

CONCLUSION: This study recommends how total wellness can contribute to older adults overall health and proposes the application of MIS be implemented in order to promote awareness about needs of total wellness and at the same time enhance their total wellness.

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A WIRELESS SYSTEM FOR PHYSICAL FITNESS ASSESSMENT: A FEASIBILITY STUDY

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INTRODUCTION: The monitoring of a population's fitness level is important because it is positively related to health outcomes [1]. When used appropriately, fitness testing can be an important aspect of children's education, as well as a useful method to monitor and track changes of physical fitness [2,3]. However, manual methods currently used are found to be ineffective and challenging. Computerised support system can be an effective data management tool when been applied to physical fitness tests. Following the increased importance of information in the field of public health care and physical fitness testing [4] it is in this paper's interest to introduce the use of a newly developed system known as Wireless Fitness Assessment and Monitoring System (WiFAMS) as an alternative method for conducting physical fitness assessment. The system combines a set of fitness testing equipment with an online data management system that integrates the use of wireless technology for data transfer. WiFAMS focuses on complementing currently used methods since current methods lack implementation of technological advances in fitness testing procedures. However, the feasibility of the use of such a system in assessing physical fitness is yet to be determined. Therefore, the aim of this study is to determine the feasibility (level of acceptance) towards the use of the newly developed WiFAMS in physical fitness assessment in schools.

METHODS: Five schools were selected using convenience sampling from secondary schools within Skudai and Johor Bahru area. Physical education teachers of these schools applied the use of WiFAMS when conducting physical fitness assessment during their physical education classes; they were then given a user acceptance test (UAT) in the form of a questionnaire. A total of 30 completed questionnaires (UAT) were returned and then analyzed.

RESULTS AND DISCUSSION: The results showed that teachers from the schools involved found the system to be feasible with high percentages in usefulness (80.4%), functionality (76.7%), reliability and validity (82.3%). This finding is similar to the findings of a study conducted to assess the applicability and effectiveness of specific software for field testing of cardiovascular fitness which also received positive comments about its use.[4] The respondents of this study found the system to be very helpful and useful especially in simplifying the process of data management since data was automatically transferred from the testing equipment to the main computer. Besides this, the capability of the system to act as a monitoring tool is highly welcomed by teachers since both teachers and parents will be able to assess student information; this is essential in enabling teachers to provide individually tailored feedback to students [5]. Additionally, past test scores could be uploaded using excel worksheets. However, a few teachers expressed their concerns regarding the use of the system for large-scale testing.

CONCLUSION: The use of wireless technology in this system is feasible and can serve to improve the process of physical fitness assessment especially by increasing the tests' objectivity and minimizing data handling. Additionally, further modifications can be made to better suit physical fitness assessment conducted on a larger scale.

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MoHE AC (VERSION 1.0): A NEW DIMENSION IN AEROBIC CONDITIONING

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INTRODUCTION: The pre-requisites of sucess in sports can be identified as technical expertise, tactical sense and psychological skill [1]. These three necessities are meaningles unless they are built upon a solid foundation of physical fitness. The complex bio energitic nature of sports such as badminton and tennis; require a specific physical conditioning programs that would be relevant to the demands of frequent competitions [2]. The principle of dynamic correspondence is particulary relevant in the application of sports specific activities towards the achievement of an optimum level of physical condition. The principle of dynamic correspondence states that special exercises must be in harmony with those parameters that characterize the needs of the specific sport. The proposed prototype aims to provide a range of activities that would enhance cardiovascular endurance through the application of sport specific activities. The capabilities of the prototype which would include player specific patterns (i.e. stroke pattern execution of regular opponents) will provide a training activity that replicates a competition in almost every aspect. In conclusion, the prototype suggested would be able to specifically prepare players by replicating competitive situations in training. By replicating sports specific conditions, the number of factors a sportsperson needs to adapt is reduced, thus increasing his or her adaptability towards a better performance. The choice of sports specific training activities must fullfil one or more of the following criteria (1) the exercise must duplicate the exact movement witnessed in a certain segment of the sports skill; (2) the exercise must involve the same type of muscular contraction as used in the skill execution and (3) the exercise must have the same range of motion as in the skill action [3].

METHODS: The aim of the study will be to investigate the influence of the training activity utilizing MoHE ATAC 1.0 on the aerobic fitness of badminton players. The effectiveness of the prototype will be tested on a group of athletes from badminton. Participants of this study from the badminton group will be divided into three groups; the experimental group utilising the prototype to develop cardiovascular endurance; the generalized activity group and the control group. Training under the respective approaches will be conducted for a period of eight weeks; with cardiovascular fitness levels tested before and at four week intervals.

CONCLUSION: The proposed prototype intends to provide sports specific activities to develop reactive agility and aerobic conditioning for athletes. The lack of sports specific training equipment has impeded the application of sports specific activities in sports. Incorporating the principle of variety and the principle of dynamic correspondence; the MoHE AC 1.0 intends to provide a cost effective solution to the challenge of incorporating sport specific conditioning activities for athletes involved in court games. The suggested prototype is unique as it is multifunctional and is able to train athletes in environments that similar to the sporting environments. The versatility of the prototype to be laid out for specific needs makes the product cost effective. Instead of purchasing products that only can be used to improve a specific physical fitness component; MoHE AC 1.0 offers a wide range of activities for the development of a number of physical fitness components. Products that are available are designed for the evaluation of physical fitness components purposes. These products utilise timing gates to measure the time taken to complete a circuit and are not cost effective.

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THE IMPORTANCE AND ENCOURAGEMENT OF PHYSICAL ACTIVITY IN SEDENTARY LIFESTYLE

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INTRODUCTION: The modern lifestyle among Malaysians leads them into sedentary lifestyle. A sedentary lifestyle is an inactive lifestyle with no or little physical activity. Based on the Third National Health and Morbidity Survey 2006 [1], about 43.7 percent of physical inactivity reported among Malaysians. Urban adults were found to be more inactive which about 45.6 percent as compared with rural adults is. The Malaysian Adult Nutrition Survey (MANS) conducted in 2003 [1] showed that only one out of six adults had adequate exercise. This goes to show that sedentary behaviour has become a norm in Malaysian society. Sedentary activities such as surfing the Internet, reading books and magazines, watching television and listening to radio, playing video games for almost a whole day with little vigorous physical activity can lead to the negative health consequences. In an environment which changes every day due to the technology, parents acted to protect their children more during transport to school or class and also playing outdoors compared with previous generations of parents [2]. The mode of transportation used also affects the frequency and intensity of daily physical activity. Physical activity also decreased as people got older, especially senior citizens. Other than bad diet lifestyle, a lack of physical activity is one the leading causes of preventable death worldwide [3]. A sedentary lifestyle and lack of physical activity may lead to or be a risk factor for osteoporosis, high blood pressure, cardiovascular disease, diabetes, and obesity. The evidence is conclusive that the physical activity can create a healthy lifestyle and prevent of any disease in sedentary lifestyle [4].

METHODS: A thorough search using online databases such as Elsevier, IEEE, Springer, PubMed and ACM digital library has been conducted in the period from May, 2014 and has ended on June, 2014 to identify and analyzed the works which have been carried out in sedentary lifestyle and physical activity. In the end of selection process, 4 studies were decided to be included and analyzed for this review.

RESULTS AND DISCUSSION: Physical activity is simply defined as any body movement produced by skeletal muscles. It includes the activities undertaken while doing household chores, playing any games, working, and others. For health benefits, all activities should be performed at least for 10 minutes. World Organization Health (WHO) recommends about 60 minutes of moderate to vigorous intensity activity per day for children and adolescents and about 150 minutes of moderate-intensity activity per week should be performed by adults. Regular physical activity: (i) promote in development and keeps a healthy musculoskeletal system; (ii) helps control weight and reduce body fat in maintaining a desirable body composition; and (iii) helps combat health conditions and diseases. Other than physical benefits, involving the physical activity in daily routine plays an important part in social and mental development of individuals.

CONCLUSION: It is not easy to accomplish a healthy lifestyle given the continuing environmental pressures which promote and facilitate a sedentary lifestyle. Therefore, the environmental factors have to be changed if physical activity strategies and interventions are going to be successful. The government may developed some parks and open space where people can enjoy their physical activities in clean and also safe environments. Besides that, encourage the public use of existing sport facilities, promote active transport initiatives (walking, cycling), ensure plenty of safe sidewalks and cycling paths, and maximize the effectiveness of programs to increase sport and physical activity participation are some efforts can be done by government and certain organizations who involved in this matter. Additional studies in future should be done to fight against unhealthy lifestyle behaviours among Malaysians.

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MATCH PERFORMANCE ANALYSIS IN WORLD ELITE AND U-21 MEN'S SINGLES TABLE TENNIS

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INTRODUCTION: In modern sport, a rising demand for excellence in high level performance of racket sports arise among sports community. Evaluation and assessment of the match performance during competitions has shown significant growth of interest and prompted good deal of scientific writings, especially in the aspect of notational analysis. This analysis tool allows the collection of a lot of very interesting data about the phases of play in each sport, to provide important information for improving both the technical and tactical aspects of play. Table tennis is one of the most popular and common sport in the world. But it can be considered a very complex sport and its development is still in progress. The aim of this study was to investigate table tennis's game structure and playing pattern among world Top Level Elite and U-21 categories of players.

METHODS: A total of 28 matches from the Semi-finals and Finals of the Super Series matches were selected for further analysis. The game structure variables selected for this study included match duration, game duration, rallies per set, shots per rally, rally length, rest time between rallies, ball in play in seconds, ball in play in percentage and work to rest ratio. Stroke type and shot outcome were chosen for performance indicators of playing pattern. Comparison of all variables between different categories was done using Independent Sample T-Test.

RESULTS AND DISCUSSION: There were statistically significant differences among categories in game duration, shots per rally, ball in play in seconds, rally length, and rest time between rallies ($p < .05$). This may be due to the higher quality of players playing against each other could prolong the duration of the game [1]. Vučković et al. [2] stated that the point was won gradually by performing high number of shots to gather the advantage at highest international quality level. Hughes [3] suggested that elite players were expected to play considerably longer rallies at their level. Others [4] mentioned that the rise in the ball in play actions can heighten the game intensity. Therefore due to the increase in the number of shots, more recovery time was needed. There was a significant difference in mean percentage distribution of push backhand, block backhand, top-counter-top backhand, flick backhand, and block forehand between Top Level Elite and U-21 categories ($p < .05$). Top Level Elite players targeted more backhand side of the table, while U-21 players preferred using flick backhand and they were forced into using block forehand instead of other attacking strokes. In shot outcomes, most of the strokes were ended as return shots. Topspin forehand was the most successful shot with the highest number of winners, while top-counter-top forehand had highest number of errors. Similar interpretations were stated by other researchers [5].

CONCLUSION: There were differences in game structure and playing patterns among the researched categories of players. This information can assist in improving technical and tactical skills of the table tennis players of the International standard.

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HAPPINESS AND MENTAL HEALTH BETWEEN AQUA AND LAND ATHLETES IN SELANGOR

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INTRODUCTION: There are is a number of benefits that associates physical activity with mental health [1]. Studies have shown that exercise reduces stress, increases self-confidence and strengthens self-conception which leads to a sense of happiness [2,3]. There is a growing body of evidence that focuses on specific exercise or physical activity, which suggests there is changes in biochemical structure of the brain that is induced through these activities compared to sedentary lifestyle [4]. Nonetheless, there in very limited work that has been done to compare these changes on types of sports or activities. Therefore, the present study examines the relationship between happiness and mental health on aqua and land athletes in Selangor. With this in mind, the researcher aims to investigate if aqua training can have a better effect on happiness and mental health as compared to land training.

METHODS: The participants of the study were 128 university athletes from various universities in Selangor involving in either land or aqua sports. The General Health Questionnaire 28 (GHQ-28) and Oxford Happiness Questionnaire (OHQ) was used to measure mental health and happiness status of the participants. The validity and reliability of the questionnaires are $r = 0.86$, 0.80 and $r = 0.90$, 0.78 respectively.

RESULTS AND DISCUSSION: There is a mean significant difference between the mental health of aqua and land athletes ($t = 2.950$, $p = 0.004$, $p < 0.05$). The study also suggests that there is also a significant difference with respect to the happiness level between the two athletic groups ($t = 2.024$, $p = 0.040$, $p < 0.05$)

CONCLUSION: It was found that aquatic athletes demonstrated better mental health and happiness status compare to land athletes. Therefore this study suggests that aquatic sports and activities may significantly reduce stress amongst athletes.

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PERFORMANCE ANALYSIS IN SOCCER: USING TABLET APPLICATION

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INTRODUCTION: Performance analysis can be defined as the analysis of data or information to help in the acceleration of athlete development. Identifying the correct performance indicators and reliable data collection methods enable accurate assessment of athletes' performances. The availability of various devices has further made performance analysis available for all levels of sport participation. With a multitude of user-friendly smart phone and tablet applications available; performance analysis results can be delivered to coaches as the game progresses and has become a major tool in ensuring success among athletes, both in individual and team sports. This study conducted on a team competing in the Malaysian Super League (soccer) utilised the Statwatch application. The application was installed into a tablet which was used as the device for data collection. Due to the specific demands of the goalkeeper a special set of performance indicators were assessed. The outfield players (defenders, midfielders and strikers) were assessed on performance indicators relevant to the demands of the game. Data was collected as the games progressed and information was transmitted to the controller for analysis before being relayed to the chief coach of the team during half time interval of the game. The tablet has emerged as a practical device to monitor player performance during games due to its user friendliness and its ease in data sharing [1].

METHODS: A Statwatch application was used as the device for data collection. Eleven people were trained on how to use the application and assisted in the collection of the data. Player's performances were observed during the matches based on the performance indicators relevant to the position of the players. Goalkeepers were assessed based on the special set of performance indicators due to the specific demand of their position while the field players were assessed based on passing, clearing, crossing, dribble, head, chasing loose ball, shot, foul and through pass. The information collected was analyzed by the controller for the analysis before being transmitted to the chief coach at half time interval of the match.

RESULTS AND DISCUSSION: The purpose of this research was to analyze the performance of the players competing in a Malaysian soccer league and to investigate the effectiveness of using Statwatch application as a new method for performance analysis. The performances of the players were recorded using Statwatch application installed in to a tablet based on the variables more relevant to the player's position. After analyzing the data obtained from four matches played by the team, the result shows that the defenders of the team performed a total of 72% success, 28% fail and the midfielders performed 62% success, 38% fail while the strikers completed 63% success and 37% fail. Based on the overall analysis of performances of the players, it indicated that there is a improvement in the performances of the players compared to their performances on the previous matches which could be resulted from the feedback the players were getting regarding to the progress on their performances as well as tactical and strategic changes the head coach adopted after being provided with the information regarding to the players performance.

CONCLUSION: Based on the results of this performance analysis carried out, Statwatch application was found to be effective and user friendly in the collection of data for performance analysis and it's also plays a significant role in providing information to the chief coach to improve his team as well as players performance. The head coach shown his satisfaction regarding to the information that was relayed to him from the matches analysed.

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PHYSICAL ACTIVITY CORRELATES OF MUSCULOSKELETAL SYMPTOMS IN SCHOOL TEACHERS

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INTRODUCTION: Musculoskeletal pain symptoms represent one of the most common work-related health problems in working populations, substantially affecting workers' productivity and quality of life [1]. Exercise interventions have shown to be effective at relieving musculoskeletal pain symptoms among workers [2,3]. This indicates that adopting a physically-active lifestyle may mitigate the prevalence of musculoskeletal symptoms, as well as being a therapeutic strategy in managing musculoskeletal symptoms. School teachers represent an occupational group among which there appears to be a high prevalence of musculoskeletal pain symptoms [4]. Complaints of lower back, neck and shoulder pains are common in this population [5,6]. Many risk factors have been implicated, such as teaching hours, awkward postures as well as mental strain [4]. However, data on associations of musculoskeletal pain with physical activity is limited. The aim of this study was to investigate the prevalence of musculoskeletal pain and its association with physical activity among school teachers. Our study hypothesises that a majority of school teachers may suffer from work-related musculoskeletal symptoms, and those who perform a regular, moderate-to-vigorous physical activity may experience less symptom occurrence.

METHODS: A cross-sectional study was conducted in a sample of 225 primary and secondary school teachers around Kajang, Selangor. Written consent was obtained from the Ministry of Education in the district where the schools were located. This research was also approved by the Ethics Committee of the Universiti Kebangsaan Malaysia Medical Center. Musculoskeletal symptoms were determined using the Nordic Musculoskeletal Questionnaire. Participants were asked whether they had experienced pain in various body parts during the last 12 months, accompanied by anatomical diagrams depicting the specified sites. International Physical Activity Questionnaire (IPAQ) was used to determine time spent in sitting and in moderate-vigorous physical activity (MVPA) daily. Socio-demographic information was also collected using a general questionnaire.

RESULTS AND DISCUSSION: Prevalence of musculoskeletal pain for the past 12 months was 87.4%. Main sites of pain were the knees (56.3%), shoulders (56.3%), neck (54.7%), and lower back (49.8%). A higher prevalence of musculoskeletal pain was reported in female teachers (p=0.006), secondary school teachers (p<0.001) and those with > 15 teaching hours per week (p=0.041). The age group with the highest prevalence of musculoskeletal pain was 41 – 50 years. Data showed that the average time spent in MVPA were 9.0 ± 14.6 min/day, which did not fulfil the general recommendation for adults of at least 30 min of MVPA daily. Only 16% of participants were classified as meeting the guidelines for MVPA. On the contrary, the average time spent in sitting was 198 ± 61.3 min/day. Mean sitting time did not correlate with the number of musculoskeletal pain sites. Daily MVPA however, was inversely associated with the number of musculoskeletal pain sites (r=-0.14, p=0.03), suggesting that musculoskeletal symptoms lessen with the increase in time spent in MVPA.

CONCLUSION: The preliminary finding suggests that participation in moderate-vigorous physical activity may potentially reduce the occurrence of musculoskeletal pain symptoms in school teachers. Nevertheless, meeting the recommendation of 30 minutes of moderate-vigorous physical activity daily among the majority of teachers in the present study is highly encouraged.

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FORCED AND VOLUNTARY EXERCISES EQUALLY IMPROVE SPATIAL LEARNING AND MEMORY AND HIPPOCAMPAL BDNF LEVELS

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INTRODUCTION: Multiple evidence suggests the importance of exercise for cognitive and brain functions [1,2]. Few studies however, compared the behavioural and neural adaptations to force versus voluntary exercise training.

METHODS: Therefore, spatial learning and memory formation and brain-derived neurotrophic factor (BDNF) were examined in Wister male rats after 6 weeks of either daily forced swimming, voluntary running exercises, or sedentary [3].

RESULTS AND DISCUSSION: Learning capabilities and short, 5-hour, and long term memories improved ($p<0.05$) similarly in the exercise groups, without changes ($p>0.05$) in the sedentary. Likewise, both exercises resulted in increased ($p<0.05$) hippocampal BDNF level. The results suggest that forced and voluntary exercises can similarly enhance cognitive- and brain-related tasks, seemingly vie the BDNF pathway.

CONCLUSION: These data further confirm the health benefits of exercise and advocate both exercise modalities to enhance behavioural and neural functions [4-7].

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VASCULAR EFFECTS OF RELIGIOUS-RELATED PHYSICAL ACTIVITIES

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INTRODUCTION: Muslims are obligated to pray 5 times daily. Each prayer is a number of rakaa completed with a set of physical movements, preferably in the neighbourhood masjid. The vascular effects of religious-related physical activities (RRPA) are not known, despite the well-known cardiovascular benefits of regular physical activity. Therefore, the current study examined the relationships of RRPA with vascular measures [1-3].

METHODS: Arterial and venous indices at rest and after 5 of arterial occlusion were examined in 192 healthy participants (age: 19-85 years) using strain gauge plethysmography [4]. The participants' RRPA were collected in a 1-to-1 interview, including prayer (PN) and rakaa number (RN) performed, distance (DW) and time (TW) required to walk to the masjid, and the daily (DA) and weekly (WA) attendance to the masjid.

RESULTS AND DISCUSSION: Resting blood flow correlated significantly with DW, TW, DA, and WA ($r=0.2$-0.4; $p<0.01$). Resting vascular resistance correlated with DW, TW, DA, and WA ($r=-0.14$-0.2; $p<0.05$). Resting venous capacitance correlated with DW, TW, DA, and WA ($r=0.14$-0.17; $p<0.05$). Resting outflow correlated with DW, TW, DA, and WA ($r=0.15$-0.2; $p<0.05$). Occlusion blood flow correlated with DW ($r=0.17$; $p=0.02$). Occlusion outflow correlated with DW and DA ($r=0.16$-0.17; $p<0.05$). Additionally, arterial and venous indices were greater ($p<0.05$) in the participants regularly prayed in the masjid.

CONCLUSION: The results confirm the importance of physical activities for the circulatory system. Uniquely, the data shows that RRPA might contribute to the maintenance of vascular function [1-3].

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COMBINING RESTRICTED DIET WITH FORCED OR VOLUNTARY EXERCISES IMPROVES HIPPOCAMPAL BDNF AND COGNITIVE FUNCTION

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INTRODUCTION: Dietary restriction (RDt) [1] and exercise (Ex) [2] enhances cognitive function due, at least in part, levels of neurotrophins such as brain derived neurotrophic factor (BDNF). This study examined changes in BDNF levels and data acquisition and retention following every-other-day RDt alone, and combined with either voluntary wheel (VxRDt) or forced swimming Exs (FxRDt).

METHODS: Hippocampal BDNF was measured using ELISA while learning and memory formation were assessed with the radial arm water maze (RAWM) paradigm [3].

RESULTS AND DISCUSSION: After 6 weeks, VxRDt and FxRDt enhanced BDNF levels, and short and long-term memories ($P < 0.05$). The magnitude of the increase in BDNF was significantly higher in VxRDt group than in other groups ($P < 0.05$). However, no differences were found in learning and memory formation between the Ex regiments (VxRDt versus FxRDt). Additionally, RDt alone neither modulated BDNF level nor enhanced learning and memory formation ($P > 0.05$).

CONCLUSION: These results suggest more important role of Ex [2,4], as opposed to RDt, in enhancing learning and memory formation. In addition, VxRDt appears to be more potent in enhancing brain BDNF levels than FxRDt, when combined with RDt.

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INITIAL EFFECTS OF PASSIVE DORSAL GLIDE MOBILIZATION IN ACUTE ANKLE LATERAL LIGAMENT SPRAINS

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INTRODUCTION: Inversion ankle sprains are the most common injuries in sporting events. These ankle sprains generally damages the lateral ligament complex of the ankle joint results in pain, swelling and decreased range of motion (ROM) [1]. Various management interventions are available for acute ankle lateral ligament sprains with no consensus. R.I.C.E protocol is one among them [2]. This protocol is commonly used by health care professionals, coaches, and athletes for an acute injury in the on-field set up. Likewise the mobilization to the joints is also widely used by the physiotherapists to alleviate pain and improve ROM [3]. This study is aimed to evaluate the effectiveness of the passive dorsal glide mobilization on ankle joint following with R.I.C.E protocol after an acute ankle lateral ligament sprains.

METHODS: The study evaluated the initial effect of the passive dorsal glide mobilization treatment technique on pain and foot and ankle ability. For the purpose of the study 17 subjects (n=17) both male and female athletes with acute ankle lateral ligament sprains were selected from various sporting events. After randomization the subjects were divided into to an intervention group (n=8) and control group (n=9). Intervention group were treated with R.I.C.E. protocol immediately after injury and passive dorsal glide mobilizations were applied after 24 hours; whereas the control group was treated only with R.I.C.E. protocol. Pain as one of the outcome measure was measured by VAS (Visual Analog Scale) and physical function as another outcome measure measured by sports sub scale of FAAM (Foot and Ankle Ability Measure).

RESULTS AND DISCUSSION: The outcomes of the experiment were statistically analysed with unpaired t-test.

Variables	Group	Mean $\pm$ SD	t-value
VAS	Intervention	4.00$\pm$ 0.93	
	Control	5.11$\pm$ 0.78	2.6771
FAAM	Intervention	50.88$\pm$ 22.53	
	Control	46.47$\pm$ 27.77	0.3479

The analysis shows that there is a significant reduction in pain on VAS (mean difference at 95% CI from -1.99 to -0.22) on intervention group by applying passive dorsal glide mobilization in addition to R.I.C.E protocol, and there is no significant difference (mean difference at 95% CI from -22.06 to 30.67) in physical function on sports sub scale score of FAAM among both the groups. This study showed that when acute ankle lateral ligament sprains were treated with passive dorsal glide of the ankle joint in addition to the conventional R.I.C.E protocol, there was a reduction of pain perception than when R.I.C.E alone was administered.

CONCLUSION: This preliminary study demonstrated a positive effect of passive dorsal glide mobilization along with R.I.C.E. protocol to reduce pain intensity initially on acute ankle lateral ligament sprains. But in other hand there was no considerable difference in physical function in both groups. Though there are limitations, conversely, an immediate application of R.I.C.E and dorsal glide mobilizations after 24 hours of an injury can be used to modulate pain following acute ankle lateral ligament sprains. Nevertheless, further studies need to be carried out in larger samples and with proper follow-ups in order to confirm the effects of passive dorsal glide mobilizations on physical function and other parameters not only in on-field set up but also in clinical set up.

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THE INFLUENCE OF LEVEL OF PRESSURE IN INCREASING THE PERFORMANCE OF AN ATHLETE FOR WALKING MOVEMENT

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INTRODUCTION: A compression stocking is a garment that is used to enhance the performance of athlete, to prevent injury and to improve their recovery process. Although there are journal papers have discussed their effectiveness on enhancing performance [1-2], others researchers dispute the finding [3-4]. [5] suggests that the level of pressure used in the experiments as the cause for the variation. This paper had investigated the different of using a graduated compression stocking (GCS) against a uniform compression stocking (UCS) for walking movement.

METHODS: Eight active and healthy male subjects were selected from Universiti Utara Malaysia (UUM). They were scanned by using a three dimensional $[TC]^2$ NX12 body scanner. Then, two types of compression socks for the scanned body parts were constructed by using the method given in [6]. The first socks were designed to exert 37.5 mmHg (5000 Pa) at the ankle and gradually reduce to 22 mmHg (3000 Pa) at knee. The second types were designed to apply a uniform pressure of 37.5 mmHg from ankle to knee. Exercise experiments were conducted to gather kinematics data. The data throughout the trial were collected using 5 Oqus cameras (Qualisys Motion Capture System, Gothenburg, Sweden) sampling at 120 Hz. 15 numbers of passive-reflective markers were placed on subject's both lower limbs. Data from the device were processed using Qualisys Track Manager software. Before each trial, the subjects were asked to perform an adequate stretching exercise and warming up for fimilarity. Markers placed on bony landmarks (medial and lateral malleolus, lateral and medial tibial plateau, lateral and medial femoral condyles, greater trochanter, anterior and posterior superior iliac spine, and the iliac crest) during the static trial were used to establish the tibial, femoral and pelvic anatomic coordinate systems. In motion trials, some of the markers used in the static trial were removed except markers at the foot and cluster markers were placed at the thigh and leg for motion tracking purposes. Subjects were asked to walk with GCS and UCS. A clear verbal instruction was given to start and stop walking.

RESULTS AND DISCUSSION: Average shank velocity for subjects when they did not wearing compression sock is 2.04 m/s with standard deviation of 0.187. Average shank velocity when the subjects wearing GCS is 2.29 m/s with standard deviation of 0.116, and when they wear UCS, the average shank velocity is 2.24 m/s with standard deviation of 0.187.

(a)   (b)
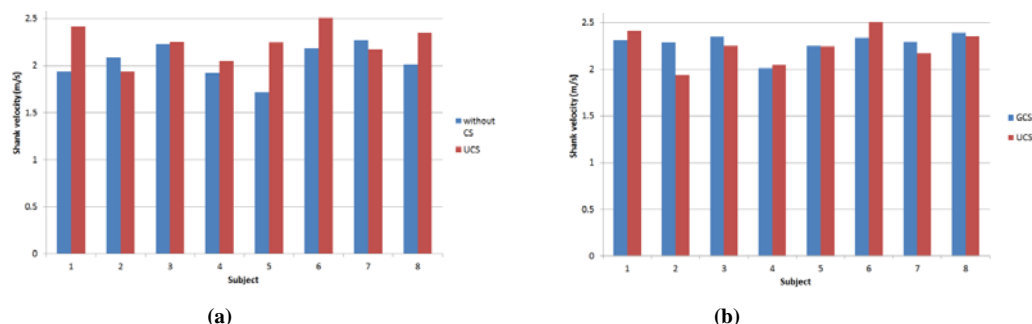
Figure 1: Comparison between (a) not wearing CS and UCS, and (b) GCS and UCS.

Fig. 1 unveils that most of UCS wearers had increase their shanks velocity. Fig. 2 shows mixed results in wearing either GCS or UCS. Both results indicate that wearing compression s can increase shank velocity. However types of the stocking, whether GCS or UCS, are not very important as long it can exert certain pressure.

CONCLUSION: This research had found that wearing CS, whether GCS or UCS, can improve shank velocity.

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THE PRESENCE OF R ALLELE OF THE ALPHA-ACTININ-3 (ACTN3) R/X POLYMORPHISM AMONG STRENGTH AND POWER ATHLETES IN MALAYSIA

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INTRODUCTION: The R allele of the ACTN3 R/X gene polymorphism has been suggested to influence the human strength and power performance [1]. While the association of ACTN3 R/X gene polymorphism has been well documented in Caucasian populations, limited information is available within Asian populations [2]. Therefore, this study was designed to explore the association of ACTN3 R/X gene polymorphism on Malaysian athletic population.

METHODS: 180 varsity athletes (148 male, 32 female) and 180 sedentary controls (70 male, 110 female) involved in the study. A sample of DNA was retrieved via buccal cell from each subject and the polymorphism was then identified through Polymerase Chain Reaction. The handgrip and leg strength of athletes were evaluated with maximal voluntary contraction tests. Chi-Square and one-way ANOVA were used to analyse the data.

RESULTS AND DISCUSSION: The R allele (0.59 vs 0.48; p=0.000) and RR genotype (0.378 vs 0.167; p=0.000) were more prevalent among athletic population compared to controls. Athletes with RR genotype recorded a significantly higher handgrip and leg strength when compared with RX and XX genotype, respectively (Table 1).

Table 1: Handgrip and leg strength value in different ACTN3 genotypes

	RR	RX	XX	P-value
Sample size (n)	68	76	36	
Handgrip strength (kg)	123.0 ± 29.8*	102.6 ± 35.5	102.6 ± 34.1	0.028
Leg strength (kg)	41.6 ± 8.4*	37.4 ± 10.2	38.1 ±10.1	0.000

Data shown as mean ± standard deviation.
* p<0.0.5, RR significantly different from RX

CONCLUSION: As more R allele is commonly found in athletes compared to controls, this suggests that the presence of R allele may confer an advantage to become an athlete. The results demonstrated positive association between R allele with muscular strength among Malaysian athletes reaffirms previous finding reported in Caucasian samples. The finding of this study highlights the importance of genetic screening in identifying future sporting talents.

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FUNCTION OF HUMAN ECCRINE SWEAT GLANDS DURING PROLONGED EXERCISE AMONG NATURALLY ACCLIMATED ATHLETES TO THE TROPICS

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INTRODUCTION: Long-term heat acclimation to the tropics has been shown to reduce sweat rate which potentially limits exercise performance [1]. This study examines the eccrine sweat gland functions during prolonged exercise.

METHODS: Sixteen tropical acclimatized well-trained male cyclist (mean $\pm$ SD age 26 ± 6 years; height 169 ± 5 cm; body mass 66.2 ± 4.4 kg; VO_{2max} 4.93 ± 0.77 L.min^{-1}) performed 60 minutes submaximal cycling exercise (60_{SM}) followed with a 10 km time-trial (TT_{10km}) in a hot-dry (HD: 32^0C and 30%rh), hot-humid (HH: 32^0C and 85%rh) and temperate conditions (TC: 20^0C and 40%rh). Local sweat rate (LSR), activated sweat gland (ASG) and sweat glands output (SGO) from left forearm were intermittently recorded in each trial.

RESULTS AND DISCUSSION: The TT_{10km} performance was significantly slower in the HH compared with the HD and TC, respectively (11.67 ± 1.94 min vs $10.15 \pm .05$ min and 9.01 ± 1.62 min; $P < 0.01$). At the end of 60_{SM}, significantly higher LSR was recorded in HH compared with HD and TC, respectively (3.1 ± 0.7 vs. 2.6 ± 0.5 and 1.5 ± 0.4 mg/cm^2/min; $P < 0.05$) with a similar trend in SGO (3.6 ± 0.7 vs. 3.1 ± 0.6 and 1.9 ± 0.4 µg/gland/min; $P < 0.05$). However, ASG was not significantly different across the three conditions.

CONCLUSION: Naturally acclimated athletes of the tropics were able to produce greater sweat rate during exercise in HH condition as a result in the increase in SGO. Despite the ability to generate higher LSR in the HH condition, the TT_{10km} performance was negatively affected. This is believed to be due to the decline in the efficiency of sweat evaporation in a humid condition [2].

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ACUTE MOUNTAIN SICKNESS PREDICTION USING PERIPHERAL CAPILLARY OXYGEN SATURATION (SPO2) DEVICE AND LAKE LOUIS SELF-ASSESMENT AMONG MALAYSIAN EVEREST CLIMBERS

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INTRODUCTION: Acute mountain sickness is a collective term in high-altitude illness. The pathophysiology of acute mountains sickness is not well understood, although studies have shown significant contribution towards the area [1]. It is a common syndrome that occurs to human at a high altitude and inherently acute mountain sickness may occur when if human body is above 2500M from the sea level [2-4]. This study is aimed at predicting acute mountain sickness using peripheral capillary oxygen saturation (SPO2) and The Lake Louis self-assessment test amongst Malaysian Everest climbers.

METHODS: A total of 10 Malaysian climbers were involved which consists of individuals at the age range of 19-50 years old. The SPO2 readings were consistently recorded at different altitude stages. Started from Kuala Lumpur to the highest point the team climbed. An average of 3 readings were recorded. The Lake Louis self-assessment test were answered when the symptom of acute mountain sickness occurred amongst the climbers.

RESULTS AND DISCUSSION: The results suggest that, as higher the altitude, conversely lower SPO2 reading were recorded. Basic symptoms were shown once the climber's SPO2 reading is below 80. As the climbers ascend gradually, the susceptibility towards acute mountain sickness is significantly reduced. This outcome suggests that acute mountain sickness may be mitigated by gradual ascension in the event of climbing the Everest. It is evident also from this study that the SPO2 device is a reliable predictive measurement device to be used at high altitudes.

CONCLUSION: This study concludes that the SPO2 along with the Lake Louis self-assessment test are an excellent prediction method to envisage acute mountain sickness for Malaysian Everest climbers.

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SIMULATING BIO-COMPOSITE CYCLING HELMET PERFORMANCE THROUGH FEA AND CFD APPROACHES

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INTRODUCTION: Finite element analysis (FEA) and computational fluid dynamcis (CFD) analysis were performed in this work as to acquire the best design for safety and aerodynamics performance of the developed bicycle cycling helmet. FEA analysis was computed in determining the critical area on both of the helmets' design that is subjected to impact; in this case a pressure load is applied on the helmet outer surface for simulating oblique loading [1]. The critical area on the helmet will be highlighted, identified and thus design improvements can be made on both of the design. Conversely, CFD analysis was executed in order to get the lowest drag coefficient number in reducing the air resistance induced by both of the developed helmet and inherently increased the cyclist performance and ensuring wining the competition [2].

METHODS: In the first stage of the FEA analysis, material property of the bicycle helmet was chosen and inserted in the user defined features available in the FEA software. Kenaf fibre is the main material for this work and will be analyse thoroughly. Static force is applied to the helmet model and as a main loading for the simulating the oblique loading occurring on the helmet. There are two initial design concepts being proposed. FEA analysis is applied to these two designs by using the FEA software in computing the different point of maximum stress. Using the same 3D drawing as in FEA analysis, CFD analysis will be performed to know and understanding the air flow that created by this bicycle helmet design. However, some simple modification is made to the 3D drawing to providing the CFD internal testing area. The inlet air flow area and outlet air flow area will be declared.

RESULTS AND DISCUSSION:
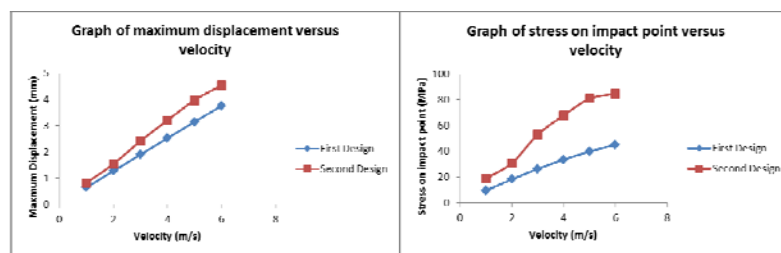
Figure 1: Finite Element Analysis.
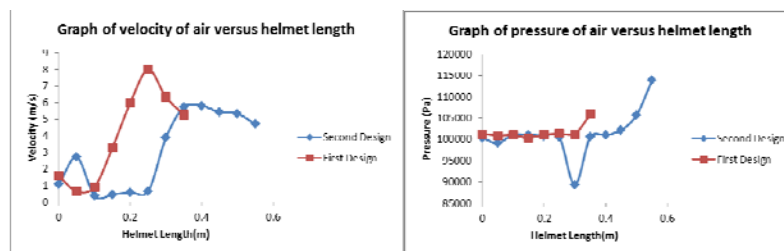
Figure 2: Computational Fluid Dynamics.

CONCLUSION: From both analyses, it was found that, maximum force and critical point can be change parallel with changing of helmet design. Playing with the design will give better output following the objective of this project which is reducing the force of impact absorbed from the collision.

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FABRICATION TECHNIQUE FOR BIO-COMPOSITE CYCLING HELMET

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INTRODUCTION: At the moment, the application of manufacturing product involve materials that can provide better qualities, such as sturdy, safe and can be manufactured easily. Ashby et al. [1] stated that there is a mounting interest in bio composites combining a bio based matrix with natural fibres. Several natural fibres, such as flax, hemp, sisal and kenaf have properties that are competitive with the ones of high tenacity glass fibres, and having a much lower density. Polymeric composite materials can offer a very high strength and require outstanding properties like high strength to weight ratios. Besides that, it can last longer in the lengthy run and can be mass-produced easily as compared to other materials, such as metal. Many researchers have industrialized composite materials that are reinforced by fibres. There is continuing technical research keen on the degree of protection offered by bicycle helmets in the event of a coincidence, and on the effects of helmet wearing on cyclist and motor vehicle driver behavior. According to Consumer Product Safety Commission [2], bicycle helmet is designed to attenuate impacts to the head of a cyclist in falls while minimising side effects such as interference with peripheral vision.

METHODS: Vacuum Bagging Process is employed in this study. Vacuum Bagging is a composite manufacturing process in which vacuum pressure is used during the resin cure cycle. Pressurizing a composite lamination serves several functions. First, it removes air trapped in and between the layers of a laminate. Second it compacts the fibre layers, allowing for efficient force transmission among fibre bundles. This prevents shifting of fiber orientation during the resin cure cycle. Third, by removing the air from the lamination, the humidity level of the laminate is reduced. Finally, and most importantly, the vacuum bagging technique improves the fiber-to-resin ratio in the composite part by eliminating excess resin. Resin Infusion utilises vacuum pressure to drive resin into the laminate.

RESULTS AND DISCUSSION: The non-woven kenaf alone cannot be shaped accordingly to the aero helmet. Fibre glass strips was used as a shaping tool and core for the kenaf to gel nicely to the mold. Due to the irregular structure of a non-woven kenaf and during hand lay-up process on preparing the product, the surface of the helmet becomes uneven and not smooth. Proper mold preparation is an essential step in the production of good moldings that come cleanly off the mold. The manufacturer's instructions should be adhered.

Figure 1: A kenaf helmet shell with fibre strips (left) and kenaf helmet shell (right).

CONCLUSION: Non-woven kenaf cannot stand alone in production. The usage of fibre glass is still a must as a core and to shaped kenaf into its mold shape. Thus the main inspiration for developing bio-composites has been and is still to produce a new generation of fiber reinforced plastics with glass fiber reinforced like or even superior properties that are environmentally compatible in terms of manufacture, procedure and removal. The raw materials being taken from renewable resources, bio-composites are prone to assimilate in to natural cycle.

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EFFECT OF VIRTUAL REALITY ON FINGERS' GONIOMETRIC MEASUREMENTS OF CHILDREN WITH SPASTIC CEREBRAL PALSY IN CONDUCTING DAILY EXERCISES

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INTRODUCTION: Children with spastic cerebral palsy often have impairments in neurological and musculoskeletal system which leads to range of motion restriction and activity limitation [1]. The needs to increase independency among children with spastic cerebral palsy are undeniable as it is important in allowing them to participate in day to day activities [2]. Even though to date a lot of studies have been carried out especially in improving the involvement of daily activities such as walking, running and climbing stairs either by using virtual reality (VR) [3], neurodevelopmental approach or even traditional physiotherapy approach, limited intervention has actually study the effect of virtual reality on goniometric measurement in conducting daily exercises.

METHODS: 12 children with spastic cerebral palsy range from 11 to 15 years old were selected from a special education school to participate in this study. They were randomly assigned to two different groups; control group and the intervention group. The intervention group received 4 weeks of VR training in 3 different daily exercises which include eating, drinking and personal hygiene exercises. They were asked to complete the task by grabbing the utensils on the screen and bring it forward to mouth. The control group attended the usual conventional exercises provided in the school. Goniometric measurements of the fingers were measured pre and post treatment.

RESULTS AND DISCUSSION: The result shows that there was no significance difference between right and left hand concerning spasticity and range of motion (ROM). However, significant interaction effect was found between group and time in relation to the average ROM of fingers' joints. In the control group, all of the participants displayed little or no improvement in ROM after 4 weeks of training. The intervention group on the other hand, displayed improvement in distal interphalangeal joint with an increment of 9° in flexion, proximal interphalangeal joint with an increment of 13° in flexion and 6° increment in flexion were reported in metacarpalphalangeal joint. However future investigation needs to be done as the length of intervention may not be sufficient enough to show an effective effect on ROM.

CONCLUSION: Outcomes from this study clearly support the idea of using virtual reality as one of the rehabilitation program among children with spastic cerebral palsy to enhance movement in their daily routines.

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FLUID STRUCTURE INTERACTION OF ROWING BLADE FOR HYDRODYNAMIC PROPULSION TO ENHANCE ROWING PERFORMANCE

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INTRODUCTION: During rowing, oar blade is pulled to generate the propulsion force and accelerating the boat. The working mechanism of the blade can be represented as a hydrofoil, where the pressure difference on the front and back surface of the blade resulting in generation of lift and drag force [1]. Varieties of blade design, produce different results on the kinetic and dynamic performance, which can be evaluated based on dynamic pressure generated [2]. An analytical processing method of calculating fluid-structure interaction (FSI) was used to investigate the effect of design parameter on blade structure. It is essentially important to understand the relation of the structure and fluid for improving hydrodynamic propulsion especially in rowing sport.

METHODS: Blade and flume model were constructed using Solidwork software which were then imported into

Figure 1: Boundary condition.

ABAQUS for the simulation. As shown in Fig. 1, at the flume inlet, fluid was set to 2.5 m/s while at the outlet opening, the static zero pressure as default [1]. Hence, the generated pressure that occurs generally due to fluid velocity passes through the static blade structure. Blade structures were held by fitting the stick at the 45 ° relative to the flume wall. In this position the lift force generated was maximized. The side wall was modelled as non-slip wall, therefore the blade is assumed to be fully submerged and the fluid-structure interaction occurs at the whole blade surface. The simulation was carried out for four different designs in order to find the effect of area and blade design with respect to fluid-structure interaction

RESULTS AND DISCUSSION: Based on the result of the solid blade in Fig. 2, the highest pressure generated

Figure 2: Pressure on the blade.

is shown in Fig. 2 (a) simplified structure of Bigblade which has the pressure value of 22.35 MPa followed by (b) Big blade 12.86 MPa, (c) Macon blade 9.410 MPa and (d) simplified structure Macon blade 7.165 MPa. This value varies due to the effect of the projection surface and blade design. Projection area for the Bigblade and Macon blade are 119041 mm^2 and 97234 mm^2 respectively, in which with the difference of 21807 mm^2, increases the pressure generated by 37 percent higher. In terms of the blade design, especially the method of inclusion of an attachment and blade platform shape, the symmetrical blade reduces the generated pressure as compared to the asymmetrical blade, as it interrupts the fluid flow and generates unsteady flow condition.
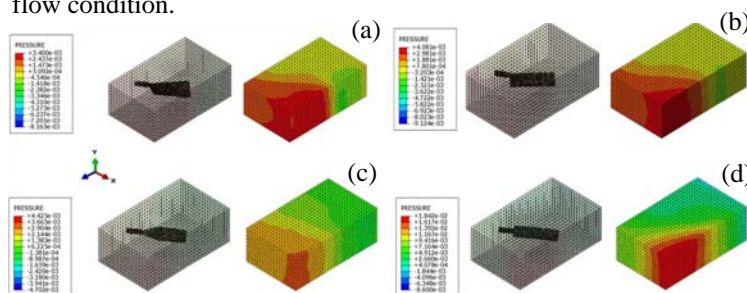
Figure 3: Fluid pressure for each blade.

As for the fluid pressure result, there are two negative and positive pressures generated to represent lift and moving fluid pressure respectively. In general, positive pressure happens at the front of the surface whilst the negative at the back surface of the blade. This situation is owed to the fluid velocity as fluid the flow from inlet to outlet, the velocity reduces gradually near the front of the blade surface. However, as the water keeps on flowing, it creates a higher flow velocity at the side and lower by approximately half of the assigned fluid velocity at the back of the blade. As illustrated in Fig. 3, the highest lift force has been generated by the simplified big blade model with the value is 0.091MPa and the arrangement of the pressure ranking is the same as blade solid model as explained previously.

CONCLUSION: The simulation results suggests that higher population force can be generated based on the lift force. This is possible owing to the design and projection area of the blade since the aquatic pressure interacts with the solid structure according to the fluid flow characteristics.

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FOOTWORK SKILL AGILITY TEST INVENTION INSTRUMENT USING KINECT SENSOR TECHNOLOGY AMONG RUGBY PLAYERS IN UTM

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INTRODUCTION: Training builds physical fitness, nonetheless the most important component of fitness is agility. Agility in the field of sports is the main factor that predicts the success of the particular sport [1]. Rugby is a highly demanding, physical, technical and tactical team sport. Agility training is the ability to quickly change direction, speed, levels and locomotor behaviour [2]. Rugby is also a sport that requires the ability of each athlete to perform the movement and change direction quickly, fast and balance. Thus, a good share of agility is able to enhance and develop the style of play and the ability of a person in terms of control and mastery white balance [3]. As such, an instrument was developed to train, observe and count the step of footwork skill or leg movements during the training. Therefore, it was identified that the use of ladder agility training responded well on the agility of a student or athlete having compromised leg movements. The ladder training is specifically developed for high-level athletes to improve their footwork skills [4]. The *KINAT ladder* is a technology based on the ladder exercise and it is used to measure the aptness of footwork skills on agility training.

METHODS: Twenty rugby athletes took part in the study, aged between 17 and 25 years old who represented different level of rugby games. All subjects were asked to perform the test "footwork skills AGILITY" by using two methods, namely conventional and KINAT. Pilot test conducted to ensure the reliability and validity of the developed instrument which can be used to test footwork skill of side step. An instrument was developed to measure the left and right foot agility and correcting ladder stepping techniques on the subject during training. The instrument was developed by combining, Windows SDK and Microsoft Kinect camera. Both tests were carried out simultaneously where conventional tests carried out in a way calculating the number of times and scores manually while KINAT test was also carried out in a way the calculation time and score refers to the application being developed. Each group conducted a test-retest for the reliability of the KINAT. Furthermore, data from KINAT LADDER were compared with the conventional method to obtain the validity. The data were collected and analysed by means of SPSS statistical tool.

RESULTS AND DISCUSSION: Test data collection was conducted through pre and post testing for a number of population of 40. The test results indicates significant difference between the mean test scores for the conventional test (t = 18.481, p = .000 (M = 27.85, SD = 2.744)) and the KINAT ladder test (t =14.752, p = .000 (M = 5.700, SD = 1.951). The results obtained suggests that the conventional method outperformed the KINAT ladder.

CONCLUSION: The instrumented KINAT ladder may be upgraded with respect to its functionality and accuracy. This device could assist in enhancing the athletes' footwork skills to ensure that they could achieve better performance.

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3D IMMERSIVE ENVIRONMENT AS A PSYCHOLOGICAL TRAINING TOOL TO ENHANCE SELF-CONFIDENCE AND INDUCED ANXIETY FOR VOLLEYBALL ATHLETES

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INTRODUCTION: In modern sports psychology, competition anxiety has been acknowledged as one of the psychological factors that will affect athletes' performance. Competition anxiety influences and affects athletes' performance by distracting athletes' from focusing on the games; causing negative effects on their performance and even interruption [1]. Anxiety is a negative emotional state that affects the physical response of the body [2]. The size and variety of the spectators, the state of striving to maintain winning position and reception of the negative criticisms often would increase the anxiety of the athletes [3]. Today, virtual reality has been developed and employed effectively for psychological training in various fields [4]. Virtual reality system may perhaps be used to display realistic 3D environment to induce anxiety, allowing resilience training and allow athletes to familiarize themselves with the high-pressure competition situations [5]. In order to minimise or overcome these problems, the idea of using virtual reality to reduce athletes' competitive anxiety is proposed for this research. The development of a 3D immersive environment will be created based on the real situations of the volleyball environment.

METHODS: The study population involved 86 volleyball athletes, which are male elite (n=25), male sub-elite (n=25), female elite (n=18) and female sub-elite (n=18), aged between 17 and 25 years old. This is a descriptive study performed using a demographic questionnaire and competitive state anxiety inventory (CSAI-2), which is used to measure the competition cognitive anxiety, somatic anxiety and self-confidence. The competitive state anxiety inventory (CSAI-2) is reliable to the respondents, where the Cronbach's Alpha was found to range between 0.80-0.87.

RESULTS AND DISCUSSION: The results show that the cognitive and somatic anxiety level of elite and sub-elite volleyball athletes of both males and females were higher than the self-confidence level. Besides, the results of the competitive state anxiety inventory (CSAI-2) between elite and sub-elite among the volleyball athletes show significant differences (p=0.03) based on all of the aspects studied.

CONCLUSION: The results suggest that the cognitive anxiety and somatic anxiety level were higher than the self-confidence level. Thus, the development of 3D immersive virtual reality will be created based on the real situations of the volleyball game environment. The design and development of this tool could help to enhance athletes' psychological skills and ensure that they can achieve peak performance.

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FINITE ELEMENT ANALYSIS: THE EFFECT OF RACKET STRUTURAL STIFFNESS TO THE BADMINTON RACKET PERFORMANCE

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INTRODUCTION: Performance of a badminton racket is often described in terms of its power and control, where power refers to the speed of the ball and control refers to the accuracy of the shot. Basically, the structural stiffness is one of the racket parameters that influence its performance. Previous study conducted by Cross investigates the effect of a tennis racket stiffness on its performance by representing racket frames as a flexible beam model [1]. Allen et al. developed a finite element model to simulate the impact of tennis balls on a freely suspended racket in order to investigate the effect of racket stiffness and ball inbound spin speed on the racket's performance [2]. Therefore, the aim of this study is to investigate the effect of a badminton racket structural stiffness on its performance. The enhancement on the design of the racket, may assist in enhancing the performance of the players.

METHODS: A finite element simulation of a collision between the ball and badminton racket was created in

Figure 1: Sequence from finite element model for an impact between ball and racket.

ABAQUS Explicit. To determine the effect of racket structural stiffness on the performance of the racket, the racket handle modelled as a fixed constraint condition while the ball was projected onto the centre of mass (COM) of racket string-bed. Initial velocity of the rubber ball before collision at zero millisecond (ms) was 10 m/s and the racket string was strung at 24 lbs as illustrated in Fig. 1. Five set of simulations were undertaken involving five racket models with different structural stiffness. The structural stiffness of the racket was adjusted by changing the cross-sectional thickness of racket shaft. Rebound velocity of the ball for each simulation was taken to obtain the coefficient of restitution (COR).

RESULTS AND DISCUSSION: Fig. 2 shows the values of COR for various cross-sectional thicknesses. It could be observed that the COR is maximum for a cross sectional thickness of 2 mm with the values of 0.413, while the COR was recorded minimum for a cross-sectional thickness of 0.5 mm with the value of 0.392. This suggests that the COR increases as the cross-sectional thickness is increased. The increases in the cross-sectional thickness, increases the structural stiffness of racket, which in turn increases the moment of inertia of the racket. Thus, a shaft with thicker cross sectional thickness was stiffer as compared to a shaft with a thinner cross sectional thickness. Therefore, stiffer racket produces higher COR which leads to a better rebound velocity of the ball. Although racket shaft with higher cross-sectional thickness was producing higher COR, nonetheless, it tends to makes the racket heavier. Therefore, to avoid the racket to be heavy, the material of the racket should be changed. Customarily, a good racket design has good flexibility and is light weight. Heavy rackets are not suitable as it could reduce the swing speed.
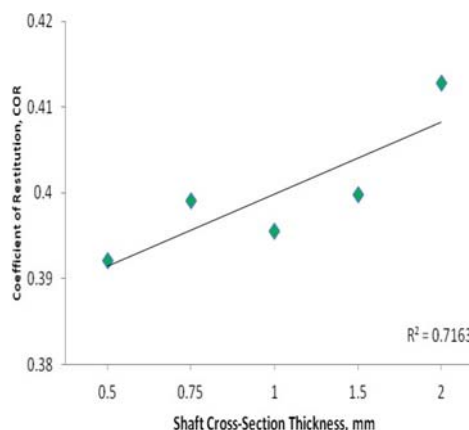
Figure 2: COR vs. cross-sectional thickness.

CONCLUSION: It is apparent that the structural stiffness of the racket significantly affects to the racket performance. The performance of the racket may be improved by increasing the racket structural stiffness. This finding assists in the design and development of a power racket which offers greater rebound velocity of the shuttlecock whilst enhancing the player's performance.

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ESTIMATION OF HEAD IMPACT POWER ON SEPAK TAKRAW PLAYERS USING FINITE ELEMENT METHOD

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INTRODUCTION: Sepak Takraw is a popular sport in South-East Asia, where in this game, players maintain the takraw ball in air by using their feet, knee, chest and head to touch the ball. A preliminary study of head injuries in Sepak Takraw was conducted by developing an experimental method to measure the Head Impact Power (HIP) of Sepak Takraw balls [1]. Photogrametrics method was also used to investigate the HIP of the takraw balls on the players during the Sepak Takraw World Cup Championship in Malaysia in May 2009 [2]. The HIP results obtained suggests that the players may experience moderate neurological injuries and in order to mitigate this issue, the use of head pads was therefore suggested for the players. This paper highlights an estimation method by employing finite element (FE) analysis to examine HIP in Sepak Takraw.

METHODS: Data collection of this study was conducted and recorded at the KFC-Utusan Sepak Takraw 2011 in Kuala Lumpur. From the recordings, the takraw ball speeds before and after headings particularly at the front-forehead from services in the games were measured. The data for speed was subsequently used for the FE simulation of the ball heading model. Similarly, the contact time of headings were also measured. A comparison between FE simulations by means of Abaqus/CAE and the actual measurements were then made. The material properties of brain tissue used in this study replicates the suggestions made in [3]. The equation proposed by Newman et al. was used to compute the HIP [4].
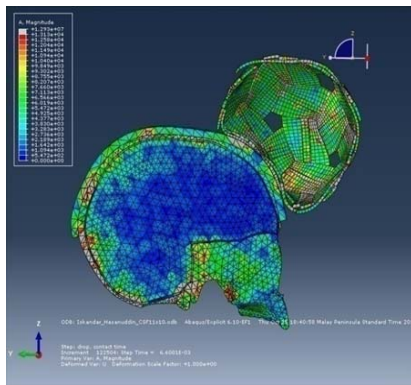
Figure 1: Finite element simulation of front-forehead heading (view cut)

RESULTS AND DISCUSSION: The present study reveals that the maximum average acceleration of the whole brain for front-forehead heading was 199.187 m/s^2 or 20.31 g at a contact time of 0.011 sec. This result indicates that the readings are still well below the border line of fatal injury according to Wayne State Concussion Tolerance Curve (WSTC) [5]. Furthermore, the experimental and simulation results of the contact time of front-forehead heading as well as the ball speed were found to be in good agreement with 93% and 95.01%, respectively. The maximum speed of takraw ball for front-forehead heading was found to be 15 m/s, whilst the computed HIP is 11.36 kW and the probability of concussion is 39 %.

CONCLUSION: It can be concluded that there is a possibility for sepak takraw players to experience mild traumatic brain injury (MTBI) caused by the collisions of the takraw balls on their heads. Therefore, this study further substantiates the need for the use of headbands to reduce the possibilities of MTBI later in life for active players due to repetitive collisions as suggested by Lipton for soccer players [6].

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THE INFLUENCE OF A COMPRESSION SOCK ON WALKING MOVEMENT

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INTRODUCTION: A compression sock is a garment that is used to enhance the performance of athlete, to prevent injury and to improve their recovery process. It works by enhancing lactate removal, reducing muscle oscillation and positively influencing psychological factors. Many journal papers have discussed their effectiveness on performance [1-4]. This paper reports on the effect of wearing compression socks on walking movement.

METHODS: Eight active and healthy male subjects were selected from Universiti Utara Malaysia (UUM). They were scanned by using a three dimensional [TC][2] NX12 body scanner. Then, compression sock for each subject was constructed by using the method given in [5]. The sock was designed to exert 37.5 mmHg (5000 Pa) at the ankle and gradually reduce to 22 mmHg (3000 Pa) at knee. Exercise experiments were conducted to gather kinematics data. The data throughout the trial were collected using 5 Oqus cameras (Qualisys Motion Capture System, Gothenburg, Sweden) sampling at 120 Hz. 15 numbers of passive-reflective markers were placed on subject's both lower limbs. Data from the device were processed using Qualisys Track Manager software. Before each trial, the subjects were asked to perform an adequate stretching exercise and warming up. Then, a practice session of the walking exercise was held for each subject prior to experiment until they feel comfortable with the movement. The practice is to ensure that the walking exercise is conducted in a correct manner. A two seconds static trial was recorded with the subject standing still to create an anatomical reference frame for each limb segment. Markers placed on bony landmarks (medial and lateral malleolus, lateral and medial tibial plateau, lateral and medial femoral condyles, greater trochanter, anterior and posterior superior iliac spine, and the iliac crest) during the static trial were used to establish the tibial, femoral and pelvic anatomic coordinate systems. In motion trials, some of the markers used in the static trial were removed except markers at the foot and cluster markers were placed at the thigh and leg for motion tracking purposes. Subjects were asked to walk in front of the camera with and without the compression socks.

RESULTS AND DISCUSSION:
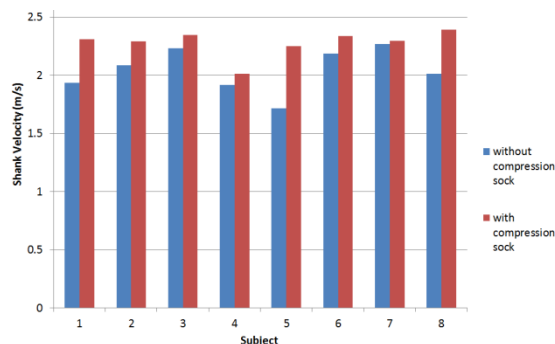
Figure 1: Result of experiment.

Fig. 1 shows that there is an increase in shank velocity for all the subjects if they wear the compression sock. However, the degree of the increases is varies among the subjects, between 1% and 31%. Average shank velocity for subjects when they did not wearing compression sock is 2.04 m/s with standard deviation of 0.187. Meanwhile, average shank velocity when the subjects wearing compression sock is 2.29 m/s with standard deviation of 0.116. Since shank velocity directly related to the walking velocity, it can be assumed that walking velocity is increased if the subjects wear the compression sock.

CONCLUSION: The experiments show that compression sock can improve walking velocity. The finding is in according with other researchers. However, the increases can also be attributed to other factors as well such as psychological effect.

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ADJUSTABLE CRANK: A COMPARISON OF NORMAL CRANK WITH ADJUSTABLE CRANK MASS MOMENT INERTIA EVALUATION

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INTRODUCTION: Sports in high performance are crucial in every precious millisecond especially in cycling. The adjustable crank is a novel type of prototype crank that is designed to maximise the minimum torque at bottom dead center (BDC) and top dead center (TDC) where the crank can be set for ± 10° maximum with addition of 5° back and forth from inertial 0° top dead center (TDC) point [1]. Therefore, the effects of mass of the adjustable crank against a normal crank will be evaluated. The objectives of this study are to (1) to study the mechanism to obtain crank moment of inertia (2) to derive equation of motion to obtain crank moment of inertia (3) to evaluate the value moment of inertia normal crank and adjustable crank.
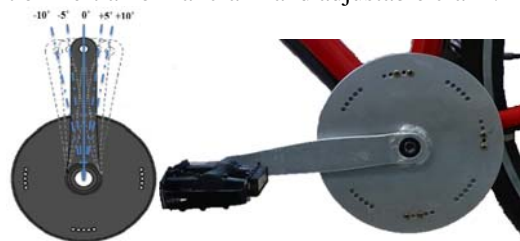
Figure 1: Ilustration of adjustable crank.

METHODS: 100N mass is hung via thread/string line from the shaft of the crank. The chain is released from the chainring and gear. The crank is rotated by hand to wrap the line around the shaft. The stationary is held at this point and then released. The time for the mass to fall for 30 separate trials is recorded. The average time is calculated. To increase the accuracy, the trial is repeated on an 80N mass. The average moment of inertia is calculated from each of the three masses. The overall amount of inertia of the crank is calculated.

$$\Delta h = v_i \, t + 1/2 \, at^2$$
$$v_i = 0 \ m/s$$
$$\Delta h = 1/2 \, at^2$$
$$a = 2\Delta h/t^2$$
$$a = \alpha r$$
$$\tau = Ia = \text{mgr} = I(2\Delta h/rt^2)$$
$$I = (mgr^2t^2)/(2\Delta h) \dots\dots\dots\dots (1)$$
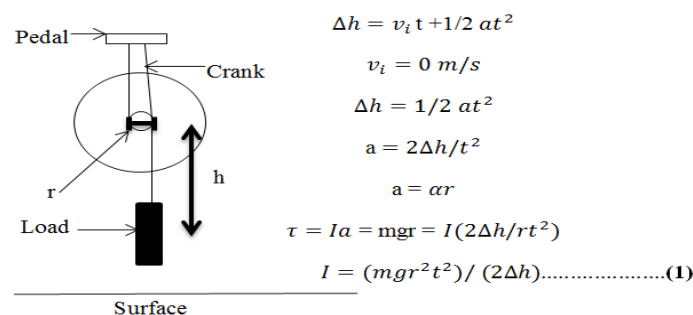
Figure 2: Mass moment intertia calculation.

RESULTS AND DISCUSSION: Two fixed load (100N and 80N) was used to calculate the time the mass to fall for 30 separate trials is recorded. The mean time for normal crank 100N was (3.63±0.18 s) and for 80 N of mass was (5.18±0.68 s). Meanwhile, the mean time for adjustable crank 100N and 80N were (3.31±0.26 s) and (3.80±0.57 s) respectively. Two-way ANOVA analysis for type of the crank were performed (P=0.00), the result was significantly different. The P value is set at P < 0.05. The calculated moment of inertia for normal crank was (0.25±0.004 kgm^2) and adjustable crank was (0.34±0.070 kgm^2). Thus, the adjustable crank and normal moment of inertia difference was increased by 26.5%.

CONCLUSION: It was found from this study that the adjustable crank and normal moment of inertia difference was increased. Nonetheless, it is also important to study the difference of the weight of the crank design with the available crank in the market. In future, the mass of adjustable crank needs to be decreased or a better design must be designed. The additional weight affects the mass moment inertia during cycling which in turn, produces draft in weight during cycling revolution.

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GAITCOACH: STABILITY AND GAIT MONITORING DEVICES FOR PARALYMPICS ATHLETE

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INTRODUCTION: Participation of paralympic sports depends on the athlete classification of the impairment. There are five different disability groups that are eligible to be involved in this sports namely spinal injury, amputee, visually impaired, cerebral palsy and les autres [1]. Most paralympic athletes are susceptible to gait problems due to their physical limitation which determines their success in each event. This paper will describe a concept of a novel wearable gait assessment device to identify gait performance related to gait stability and gait pattern for field training monitoring purposes.

METHODS: The initial idea came from the paralympic athletes and coaches to maximise the athletes' performance. A user-needs analysis was conducted to identify the challenges with the athlete's ability to maintain balance during gait related sport activity. GaitCoach is a wearable device that able to initially identify the athlete gait stability and gait pattern and support the laboratory motion analysis (rather than attempt to replace them). The design and development of the device requires a multi-disciplinary team that consists of rehabilitation therapists, sport scientists and mechatronics engineers. An initial experiment was conducted with left leg amputee and a prosthetic user that interested in athletic sports. A wearable sensor is placed on both subject's wrists and calves.

Figure 1: Initial GaitCoach Prototype.

RESULTS AND DISCUSSION: The result indicates that GaitCoach can be used as an initial assessment to identify the athlete gait stability and gait pattern based on the upper limb and lower limb motion; which allows the coaches and athlete to identify the athlete problem related to gait during field training by referring to the screen monitor. An initial testing comparison between the right and left lower limb indicate a difference of 18.2 degree range of motion. The comparison between right and left upper life indicate a difference of 12.5 degree range of motion. The differences in range of motion between right and left side suggests the asymmetrical movement of the subjects.
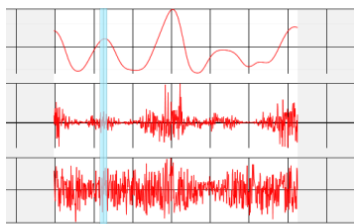
Figure 2: Left Legs Range of Motion.

CONCLUSION: GaitCoach could assist coaches to monitor paralympic athletes' gait performance especially the gait pattern and the gait stability during gait related activities. The acceptance of GaitCoach will depend on the athletes' achievement, the use of this tool by the coaches and athlete and the ease of use of the system for gait analysis.

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CHARACTERISATION OF LIGHT WEIGHT COMPOSITE PANELS FOR TABLE TENNIS TABLE

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INTRODUCTION: The use of composite sandwich panel in sport is growing rapidly due to its desirable features such as high strength to weight ratio and low maintenance cost [1]. However, little research has been undertaken into the development of a light weight, strong table tennis surface from fibreglass facesheet and foam core. Fibreglass is a lightweight, extremely strong stiff material, with Young's Modulus of around 17.2 GPa fibre-reinforced composite made of a plastic matrix reinforced by fine fibers of glass. Fibreglass also exhibits very low moisture absorption, with the moisture content of almost 0% [2]. Meanwhile foam is a strong, lightweight material that is widely employed as the core material in sandwich structure due to its isotropic property hence providing more uniform property across the panel [3]. This will reduce the variability of the result from the restitution test. However, it is likely that impact loaded sandwich structures will absorb significant energy in contact deformations local to the point of impact [4]. Therefore it is of interest to study how this energy dissipation will effect on the restitution property of the sandwich panel constructed with foam as the core.

METHODS: Three types of similar size composite panels with different face sheets were manufactured to look at the effect of various cores on the restitution properties as shown in Table 1. International standards set up by International Table Tennis Federation (ITTF) were used as a guideline to characterise the panels.

Table 1: Manufactured Panel.

Panel	Core Type	Face Sheet Type
1	Foam	3 Ply Veneer
2	Foam	2-Layers Fibreglass
3	Foam	3-Layers Fibreglass

There were 120 testing points on each panel, placed in equal length between each other. Each of the testing point restitution property was tested by dropping the table tennis ball from a fixed height of 300 mm and the maxiumum height that the ball reached was recorded. For all the testing panels, each testing point was tested once. 10 random testing points on each panel was selected to validate the consistency of the rebound height.

RESULTS AND DISCUSSION:
Fig. 1 illustrates that the average restitution amplitude for the panel with two layers fibreglass face sheet does not vary much with the 3 ply veneer face sheet panel. This suggests that the local flexural stiffness of the two layers face sheet is nearly the same as the 3 ply veneer face sheet. However, there is a noticeable increase in the restitution property for the three layers fibreglass face sheet panel. This is thought to be due to the three layers fibreglass face sheet having a higher global flexural stiffness therefore contributing to a higher bouncing of the table tennis ball. There is significant variation in the restitution profiles of both fibreglass face sheet panels as compared to the 3 ply veneer face sheet panel. All samples pass the minimum criteria to get approved by the ITTF, where a standard table tennis ball needs to display a rebound of within the range of 230 - 260 mm when it is dropped from a height of 300 mm [5].
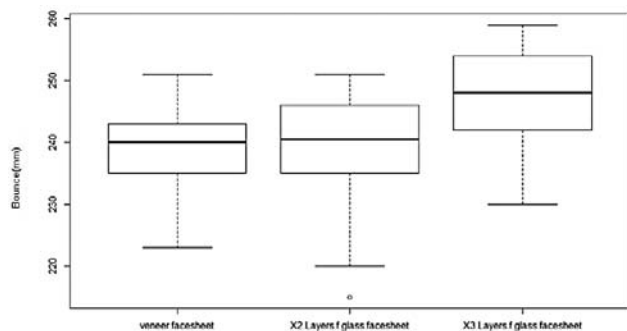
Figure 1: Bounce vs Face Sheet Type.

CONCLUSION: In comparison of different face sheets with foam core, three layers fibreglass face sheet panel exhibits highest restitution profile, at the expense of consistency. Meanwhile, the average restitution amplitude for the panel with two layers fibreglass face sheet does not vary much with the 3 ply veneer face sheet panel. The composite panels would be suitable for casual table tennis table and could be a viable alternative for a competition tables with further research on the production cost.

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INVESTIGATING THE AIMING AND SHOOTING POINT OF THE JUNIOR ARCHERS

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INTRODUCTION: The radial deviation is one of the important parameters to identify the performance of an archer. It provides more information than the score because the same score may have different radial distance [1-3]. Lin and Hwang [1-3] investigated the correlation between the aiming adjustment trajectory and the shot points. However, hitherto, the simultaneous analysis along the vertical, horizontal, and radial directions have not been studied. Therefore, in this paper, the vertical, horizontal, and radial deflections will be investigated to analyze the correlation between the aiming procedure and shooting points.

METHODS: We employed two digital videos to record the aiming time and shooting points. The aiming time is defined as the period after the anchor stage and pre-releasing the arrow that accurately recorded from a digital video camera. The vertical, horizontal, and radial direction coordinates are captured by another camera placed in front of the target. Subjects are divided into three categories according to their experience and age (see Fig. 1); beginner, intermediate and elite (SUKMA archers).
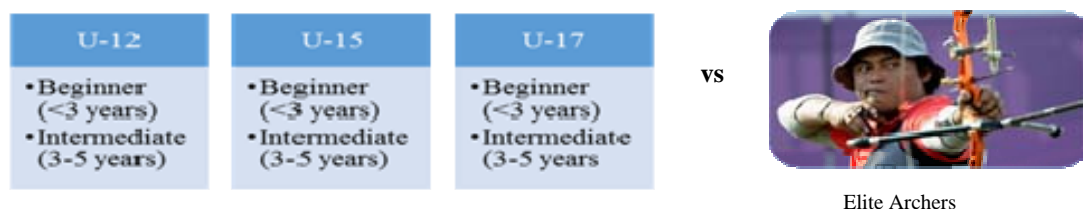
Figure 1. Classification of the archers are on the basis of the experience and age.

RESULTS AND DISCUSSION: The average of aiming time, radius distance and score of U-15, U-17 and elite archers are shown in Fig. 2 (a), (b), and (c), respectively. From these figures, it can be interpreted that the elite archers produce the highest scores with shorter aiming time. One possible explanation is that the less aiming time minimize the vibration of the arm, thus increase the performance of the archers.
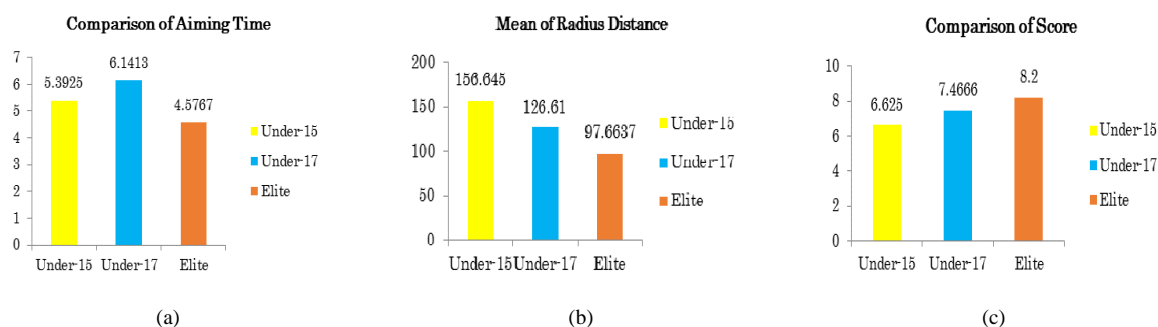
Figure 2. The average of (a) aiming time, (b) radius distance, and (c) score among U-15, U-17, and elite archers.

CONCLUSION: The objective of this study is to investigate the aiming time and shooting point along the vertical, horizontal and radial direction of the U-15, U-17 and elite archers. Our finding shows that the U-15 and U-17 archers were underperformance due to the large period of aiming time. In future, this weaknesses can overcome with a computer assists aiming device which aiding the archers and coaches to improve the performance of the U-15 and U-17 archers.

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DEVELOPMENT OF A TRACK CYCLIST PERFORMANCE MONITORING SYSTEM USING WIRELESS SENSOR TECHNOLOGY

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INTRODUCTION: Track cyclist performance is influenced by several factors namely environment, mechanics, psychology and physiology. From a physiological standpoint, the performance is often measured by the heart fitness [1]. Conversely, physiological performance are monitored via the cyclist heart rate variability (HRV) and skin temperature during training. The HRV signal reflects the myocardial oxygen consumption [2]. Skin temperature is a basic factor for physiological monitoring in which a slight change in core body temperature can affect comfortability [3]. HRV and skin temperature are monitored and recorded with respect to cycling speed and distance travelled. The signal from each sensing node transmitted wirelessly, processed, displayed and recorded at the based station to reduce the sensing power consumption.
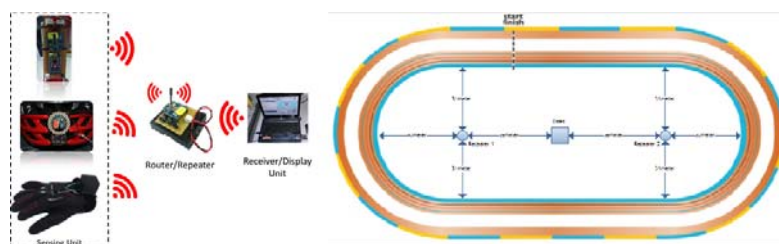
Figure 1: System overview.

METHODS: Photoplethymography (PPG) attached to the cyclist's glove is used to detect the heartbeat, which the time interval between heartbeats is calculated to provide the HRV. HRV during cycling must kept between 50 to 85 per cent from maximum HRV according to Karvonan formula [1]. Heart fitness level [3] is indexed after getting different HRV during cycling and 1 minute after cycling [2]. The forehead skin temperature average is obtained from two sensors that sense temperature through contact and non-contact probe placed on the cyclist's helmet. The sensors are placed on national junior track cyclist in a velodrome and the data collected is based on sequence to monitor packet drop.

Fitness Scale	
Outstanding	>6
Excellent	4 to 6
Good	3 to 4
Fair	2 to 3
Poor	< 2
Critical	≤ 1.2

Table 1: Fitness scale

$$HRV_{max} = 220 - age \quad \ldots(1)$$
$$\Delta HRV = HRV_e - HRV_r \quad \ldots(2)$$
$$F_i = \frac{\Delta HRV}{10} \quad \ldots(3)$$

HRV_e = Heart rate before stop training
HRV_r = Heart rate 1 minutes after training
ΔHRV = Heart different
F_i = Fitness scale
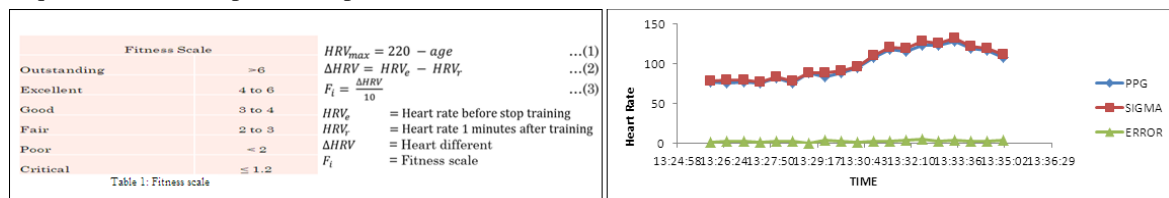
Figure 2: a) Heart fitness scale, b) Comparison between PPG and Sigma.

RESULTS AND DISCUSSION: PPG provides high accuracy readings to up to 97% as compared to Sigma HRV commercialised belt. Xbee wireless modules with Zigbee protocol applied to the sensors have small power consumption with better range up to 60 meter radius which 30 times greater than Sigma belt . Wireless packet drop reduced from 46% to 3% when wireless signal range extended using two repeaters to cover whole velodrome.

CONCLUSION: Cyclist HRV, skin temperature, cycling speed and distance monitored and recorded together in real time condition during a training session on velodrome provides useful information about the cyclist performance. This enables the coach or sports physician to manipulate training schedule or strategy to optimise the cyclist performance without imposing overtraining condition. In future, fusion algorithm will be applied to the system to cater for fast cyclist performance apart from increasing the accuracy of the performance prediction.

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ARDUINO-BASED WIRELESS SENSOR NETWORK FOR TRACK CYCLING PERFORMANCE MONITORING

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INTRODUCTION: In Malaysia, track cycling is considered as one of the sports that have received significant interest for the past few years. Malaysia Sports Council (MSC) is the government agency that is responsible to develop the performance and talent of local cyclists. This study aims at measuring the performance of the bicycle speed and cadence on the basis of building a wireless sensor monitoring system, which involves several electronic and wireless technologies, such as: (i) ZigBee wireless modules, (ii) Arduino Nano platform and (iii) magnetic sensor, due to its low power consumption [1], small size, lightweight, low cost [2], flexibility, low complexity [3], and can be remotely monitored via radio frequency (RF) link.

METHODS: The proposed wireless sensor network (WSN) hardware configuration and platform is shown in Fig. 1. It is consists of (i) sensor node and (ii) coordinator node. The sensor node monitors important track bicycle parameters, namely cadence (RPM) and speed (KPH). The sensor nodes comprise of Zigbee (Xbee series 2) transceiver, Arduino Nano microcontroller ATmega 328, and magnetic sensor. The coordinator node receives the transmitted data of the speed and cadence. It comprises of Zigbee (Xbee series 2) transceiver, Arduino Mega 2560 board, and LCD to display the received data. Both sensor and coordinator nodes are characterised by low power consumption and relatively small in size.

RESULTS: The measured data of speed and cadence are transmitted wirelessly by ZigBee sensor node to the ZigBee coordinator node, which eventually connected to main microcontroller, Arduino Mega 2560 as the head unit. The head unit will be located at the bottom of the bicycle's seat post to reduce the aerodynamic resistance. The main microcontroller receives and organizes the flow of data coming from the sensor node and also it processes this data based on a pre-programmed algorithm, which is written in C language [5] to compute the bicycle's performance, which in turn is displayed on the LCD to be viewed by the cyclist. As a further extension, these bicycle parameters can be transmitted to the coaching team via infrastructure-less (e.g.: RF, ZigBee) network to leverage from the real-time monitoring as a recorded result depicted in Fig. 2.
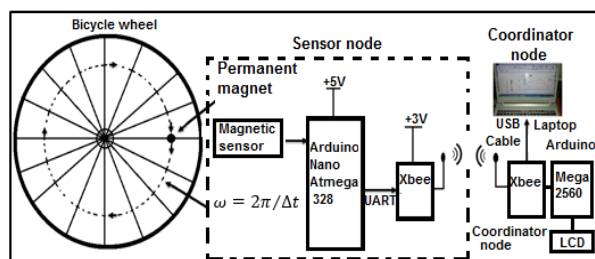
Figure 1: Proposed WSN and measurement system.   **Figure 2: Real-time measurements of bike speed and cadence.**
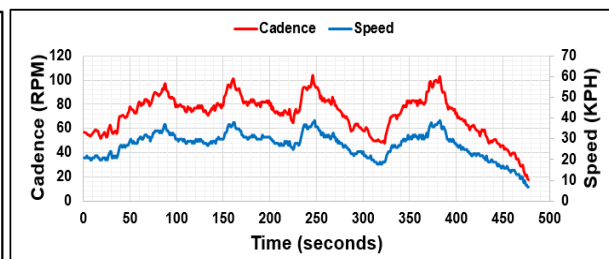
CONCLUSION: In this study, the track bicycle speed and cadence measurements were presented based on Arduino Nano and ZigBee (Xbee series 2) wireless standard. The main goal of the proposed WSN platform is to monitor the performance of the track cyclist performance based on the cadence and speed parameters. However, there are still some design challenges that should be taken into considerations, such as data transfers, lightweight, power efficiency and more advanced bicycle performance metrics.

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INVESTIGATION OF HAND KINEMATICS TOWARDS FRONT CRAWL SWIMMING USING NON-INVASIVE REAL-TIME MONITORING SYSTEM

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INTRODUCTION: The rapid growing technology to assess self-improvement and optimise training process are to be of major importance to sport scientists and coaches. Studies show that skill specifics and repeatability measures were ranked as the two crucial parameters for swimmers [1]. At present, the kinematics and performance monitoring in swimming are generally captured using high-speed video-based systems. In [2], a musculoskeletal simulation of the breaststroke using video based system is developed. A three-dimensional hand kinematics that was captured using motion capture system, suggests that the hand kinematics significantly affects the swimmer's velocity [3]. Nowadays, sports scientists have employed the use of micro electromechanical system (MEMS) technology with inertial measurement unit (IMU) incorporating accelerometers and rate gyro sensors. A wearable single sacrum mounted accelerometer was implemented in [1]. In [4], direct comparison between accelerometer-based and tethered velocity meter is demonstrated. An object-oriented technique was proposed in [5] to formalize and structure the development of a computer-integrated real time monitoring system. The hand kinematics also has been considered in order to develop a comprehensive analysis of the swimmer's performance [2, 6].

METHODS: The study involves the integration of monitoring tools using IMU and wireless network systems to ensure that the system will not impede the swimmer's movements during the measurement process [7]. The marker locations as illustrated in Fig. 1 as proposed in [3] will be replaced with the IMU system in this study. Kinematics of the landmarks used in determining the pitch and sweepback angle that causes significant effect to the body velocity will be acquired for further correlation analysis. The sensors are attached to the swimmer before the training session. A tethered speedometer will be used as the velocity reference measurement.
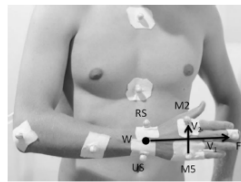
Figure 1: Example of sensor location for hand kinematics measurement. [6]

RESULTS AND DISCUSSION: Statistical analysis using correlation method of the hand kinematics measurement with the body velocity of swimmer's will be performed in order to investigate the effects of these parameters towards swimmer's performance. The Bland-Altman analysis also will be utilised to ensure the agreement between the hand kinematics and the body velocity during the swimming phase. Zero crossing detection algorithms will be used to detect the body roll of a swimmer. The zero crossing detection algorithms is usually applied to find stroke durations and widely implemented in swimming analysis [2-7]. As a result, if the effects of hand kinematics and the swimmer's velocity could be extensively investigated under various possible conditions, an enhancement of the athlete's performance may be obtained.

CONCLUSION: This analysis will assist coaches identify the strengths and weakness of the swimmers during training sessions as well as the design of an optimal personal training strategy to improve their performance.

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A NEW APPROACH OF NON-INVASIVE TECHNIQUE TO CLASSIFY THE MUSCLES AND BODY MOVEMENTS PATTERN FOR WEIGHT LIFTING ATHLETE USING ELECTROMYOGRAPHY (EMG)

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INTRODUCTION: The understanding of muscles and body movements' pattern are crucial, in order that athletes could effectively control the involved muscles and body parts based on their respective sports. This complex involvement of the muscles demands a specific technological and methodological approach, adaptable in any circumstances [1]. Therefore this study aims to develop a non-invasive technique to categorize muscles movement pattern using electromyography (EMG) signals. This enables the analysis of the function and coordination of the muscles in different movements and postures during weight lifting training. In this study, 16 UTeM weight lifting athletes ranging from novice to advanced level lifters are involved in performing squat-press exercise and weight lifting training. Inertial measurement units are placed on the athletes' bodies to acquire the accelerometer data. A novel data acquisition and signal processing approach will be developed to estimate the amplitude in EMG signal of muscles threshold for weight lifting athlete. This will differentiate between four quality groups (poor, fair, good, and perfect) and discriminate between a novice athlete and an advanced athlete [2]. The establishment of this method is crucial in order to study the muscles and body movements' pattern which in turn will enhance the performance of weight lifting athlete. These findings will also serve as a guide in enhancing the performance of athletes in other sports as well.

METHODOLOGY: **1) Location and orientation of the electrodes** - The electrodes are placed between the motor point and the tendon insertion or between two motor points, and along the longitudinal midline of the muscle. The longitudinal axis of the electrode (which passes through both detection surfaces) should be aligned parallel to the length of the muscle fibers. **2) Real Training Recording** – All 16 subjects (expert and beginner weight-lifting athletes) are involved in the EMG biosignal recordings throughout their training. Suitable electrode sensors (Ag/AgCl) attached to the subject to record their muscle activity for every specific task which includes the left ankle, the lower back by attaching it on a belt and the left wrist. The electrode sensors used are disposable Ag-AgCl biopotential skin electrodes or grass electrodes and gel is used as electrolyte [3]. The procedure of signal recording will adhere to the international electrode position standard. Recording process is done using specific bio amplifier data acquisition (BMA-931 Bio-Potential Amplifier) to detect the signals.

RESULTS AND DISCUSSION: The athletes were asked to perform three sets of thrusters at a freely chosen weight. The first two sets consisted of ten thruster moves with a barbell weight, *wBB*, allowing the athletes to perform the exercise at the best of their skill level. We allowed the athletes to have a two minute rest between each set. The number of repetitions was not specified for the last set, but the athletes were asked to load the barbell with a 3 repetition max (3 RM) weight; a weight they considered light enough to be able to perform three thrusters, but possibly not a fourth one. The last set aimed at providing data for exhaustion detection. The demographic data (age, sex) and experience level for functional fitness in general of the athletes were recorded. Their body weight (*wB*), body height, squat depth and arm length were also recorded.

CONCLUSION: Over the past few decades, the preferred manner for processing the EMG signal was to calculate the Integrated Rectified signal. This is done by rectifying (rendering the signal to have excursions of one polarity) the EMG signal, integrating the signal over a specified interval of time and subsequently forming a time series of the integrated values. This approach became widespread and it was possible to make these calculations somewhat accurate and inexpensive with the limited technology in the earlier decades. The advances made in electronic devices during the past decades have made it possible to conveniently and accurately calculate the root-mean-squared (RMS) and the average rectified (AVR) value of the EMG signal.

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FINITE ELEMENT MODELLING OF SOCCER BALL

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INTRODUCTION: In order to further understand the physics behind ball impact, researchers have used finite element (FE) method to develop ball models and simulate the impacts of interest. Most of the published work on advanced soccer ball modelling are from Price et al. [1–5]. Rezaei et al. [6] have also developed an FE model of soccer ball to analyse the oblique impact of soccer ball, whilst Asai et al. [7] have used the FE method to study the curve soccer kick. This paper focuses on the development of a three-dimensional soccer ball FE model that will be used for ball-to-head impact analysis.

METHODS: The model was developed using a hollow spherical shell that possesses isotropic material properties. The surface of the shell was discretised into spherical octahedron, which has satisfactorily support structured quadrilateral element mesh. The composite shell element includes two layers, namely inner bladder that is 0.2 mm thick, and outer panel that is 2.2 mm thick. Material properties of each constituent layer of the ball were extracted from [5]. Tensile response for both layers were applied to the model by fitting a hyperelastic reduced polynomial strain energy potential equation against the tensile test data. Stiffness proportional damping coefficient was applied to the composite outer panel to describe the energy losses throughout the impact. Pressurisation of the ball was done using surface-based fluid cavity technique. Pressurisation was performed slowly using 'smooth step' amplitude, since abrupt increase in pressure inside the cavity will result in explosion of the ball.

RESULTS AND DISCUSSION: Price et al. [5] have conducted several dynamic impact tests on the soccer ball. Since the model developed is based on the material properties of Price's model, it is appropriate to validate the model against Price's model and experimental data. Fig. 1 shows the comparison between both models. It is observed that albeit being relatively simple, our model agrees very well with Price's detailed model. The graphs also show that both COR and contact times are inversely proportional to the inbound velocity, whilst the longitudinal deformation was found to be proportional.

(a)	(b)	(c)
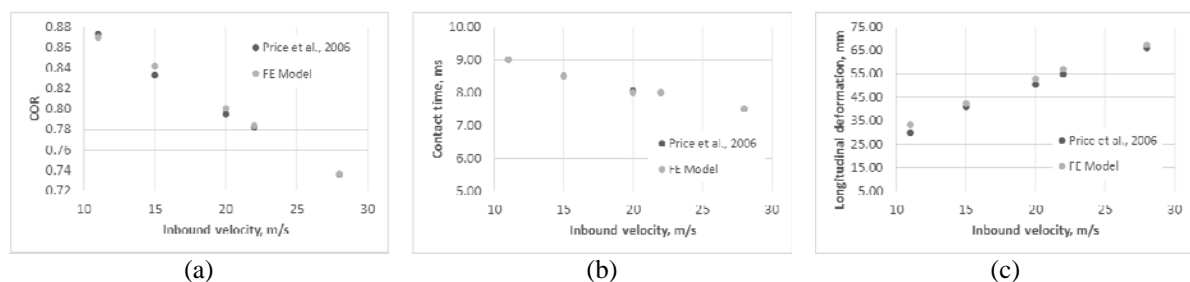
Figure 1: Comparison between our model and Price's detailed model in terms of (a) COR, (b) contact time, and (c) longitudinal deformation.

CONCLUSION: This paper has focused on the development of a soccer ball FE model that has been validated against Price's detailed model [5]. A systematic and correct method in developing a pressurised soccer ball was performed. It is observed that a simplified model is adequate enough to simulate soccer ball impact. Both coefficient of restitution and contact time were in excellent agreement as compared to a more detailed model. However, a detailed model that contains finer mesh is superior in predicting the shape of the ball compared to the simplified model. Nonetheless, the simplified FE model of soccer ball is sufficient in most cases.

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SHOE SIZING SYSTEM FOR MALAYSIAN YOUTH SOCCER PLAYERS: A PRELIMINARY STUDY ON THE FOOT ANTHROPOMETRY

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INTRODUCTION: Body anthropometry and size are two significant ergonomic factors that defines the performance of an athlete in any sports. The intricate nature of the human foot plays an important role for the performance of a soccer player amongst other factors [1]. The human foot has been studied extensively around the globe with respect to forensic study, shoe design and also for shoe sizing system [2,3]. A good understanding of foot anthropometry and shape is also helpful in designing a footwear that enhances the athletes' performance [4]. To the best of the authors' knowledge, this is the first study ever conducted in evaluating Malaysian youth soccer players' foot anthropometry. The ultimate objective of this study is to establish a fact that there is a need for a new sizing system for Malaysians that is not only based on one's foot length, but also other significant anthropometric parameters, however this paper will only report preliminary findings on the Malaysian youth soccer players' foot anthropometry measurements.

METHODS: The anthropometry collection study was performed on 73 young male soccer players from the Sports Council of Terengganu (MSNT) and Pahang Sports School (SSMP) between the age, weight and stature of 14.78 ± 1.23, 57.32 ± 8.64, and 1652.26 ± 67.42, respectively. All subjects did not exhibit any form of foot illness or abnormalities. All subjects were instructed to wear sleeveless shirt and short pants, as well as being barefoot throughout the study to facilitate the body land marking and measurements process which conforms to ISO 7250-1 [5]. A total of 22 measurements consisting of 11 measurements on each foot side were recorded. Foot measurements were made under "unloaded" conditions using an adjustable chair that can adjust the foot rest height with a 90 degree angle at the ankle joint [6]. An anthropometry measuring set from Mentone Educational Centre (Australia) was used in this study and all measurements were recorded in millimetres. The study was done at the Centre for Sports Engineering (CenSE), Universiti Malaysia Pahang and Biomechanics Lab, SSMP.

RESULTS AND DISCUSSION: The mean and standard deviation (SD) of 22 foot anthropometry were determined. All parameters were statistically significance ($p<0.05$) with one sample t-test. The statistical comparisons between the right and left foot are shown in Table 1. It is apparent from the table that the instep circumference, foot breadth, and bimalleolaar width of right foot are higher as compared of those on the left foot. It is also evident that the heel ankle circumference of left foot is higher than right foot. There are no significant difference found in other measurements.

Table 1. Comparison of parametric statistics of right and left foot.

Parameter	Right foot (mm)		Left foot (mm)	
	Mean	SD	Mean	SD
Ankle circumference	241.85	18.78	242.88	19.98
Heel ankle circumference *	322.38	15.92	324.41	16.06
Ball of foot circumference	247.99	13.35	247.04	12.48
Instep circumference *	247.66	12.94	246.37	11.78
Lateral malleolus height	64.78	6.92	64.95	6.41
Medial malleolus height	81.32	6.72	81.38	6.45
Foot length	248.94	10.62	249.36	10.36
Ball of foot length	163.96	15.92	163.96	15.41
Foot breadth *	99.29	5.64	98.34	5.76
Bimalleolaar width *	71.42	5.57	70.26	4.80
Heel breadth	52.76	4.85	53.27	5.27

Independent samples test; * $p<0.05$

CONCLUSION: The study provides a preliminary insight on the statistical comparison between the left and right foot of Malaysian youth soccer players and its significance. Future works will explore the statistical anthropometric correlation between playing positions, the right and left side of the foot as well as age group.

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AERODYNAMIC STUDY OF MODERN SEPAK TAKRAW BALL: FLOW VISUALIZATION TEST APPROACH

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INTRODUCTION: The aerodynamics of sports ball, plays a prominent role in determining the outcome of the sport especially in the ball's trajectory owing to its different shape and size. One of the uniqueness of a sepak takraw ball is its geometry. Its hollow spherical shape consist of several pentagon holes differs the ball from any other sports. The ball also is made of several spherical hoops which intertwines with each other. One of the methods in analysing the aerodynamics of sports ball is via wind tunnel experiment. Through this experimentation, the aerodynamics can be analysed through flow visualisation analysis. Flow visualisation tehcnique has been employed in tennis [1], soccer [2, 3] and golf [4]. The objective of this research is to investigate the flow field produced by sepak takraw ball from an aerodynamics standpoint. Since the experiment focusses on using smoke visualisation. hence the speed is limited to 3 m/s and the ball is in static position.

METHODS: The test was conducted in an open type wind tunnel at International Islamic University Malaysia (IIUM). The wind speed set up for the experiment is approximately 3 m/s with the size of opening 40 cm x 40 cm with turbulence intensity of 0.1% or less. Computational Fluid Dynamic (CFD) analysis was also conducted by means of ANSYS CFX to compare the results obtained from CFD as well as experimentally.

RESULTS AND DISCUSSION:
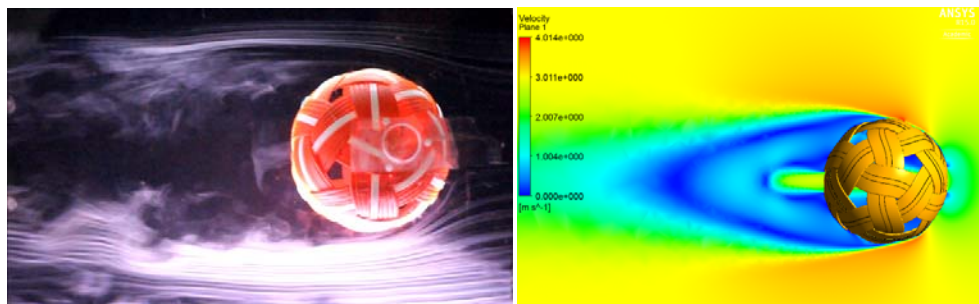
Figure 1: Flow comparison between experiment and CFD.

The holes in a sepak takraw ball delays the transition of the reduction of drag. The significant effect from the holes is illustrated in Fig. 1 where the air passess through the ball makes the wake more chaotic which in turn delays the turbulence transition.

CONCLUSION: The study indicates that the sepak takraw at the speed of 3 m/s falls under the subcritical flow field catergory where turbulence transition does not occur. This phenonemon in turn suggests that drag does not transpire at that speed.

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A PROPOSED STANDARD METHOD FOR MEASURING THE COEFFICIENT OF RESTITUTION OF A TAKRAW BALL

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INTRODUCTION: The sport industry has become ever more adept at exploiting leading-edge technologies to create more efficient equipment. One parameter that requires the utilisation of such technological advancement is the coefficient of restitution (COR). COR is important in sports engineering research especially in the development of new material of the sport's ball [1], sport injury analysis [2] as well as game performance [3]. This study proposed a standard test method to determine the COR using high-speed video in a two-dimensional setting for capturing the behaviour at different point of contact (i.e. along line of impact). Hitherto, there is no proper method in determining the takraw ball's COR upon considering different point of impacts that may affect by the ball's trajectory and spin.

METHODS: The experimental setup is based on horizontal drop test procedure [4] for different drop heights (from 1 to 3 meter) and at each point of impacts as depicted in Fig. 1. Three different faces of the impact point were selected to have a good representation of the overall surface of the ball. Different ball brands from the official ISTAF Takraw ball were used. The velocity of the ball before and after the impacts were experimentally measured and the ratio of the ball velocity before and after the impact is used to determine the COR value [5]. The range of COR at different drop heights and point of impacts are measured to determine the percentage difference between the maximum and the minimum value of COR. The range of the CORs obtained were also compared with other test method based on the free fall first-bounce height data of various takraw balls [6].
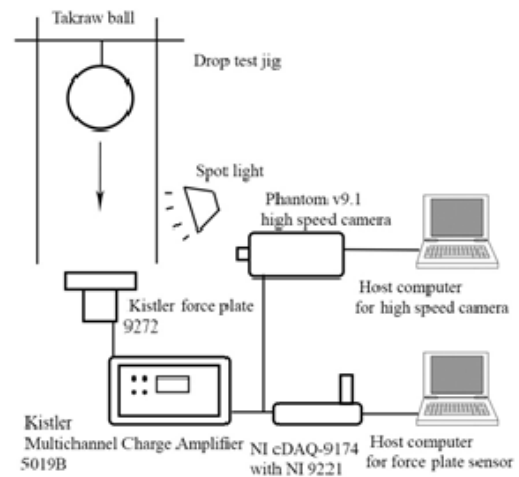

Figure 1: Drop test experiment setup.

RESULTS AND DISCUSSION: The COR obtained in this study ranges between 0.700 and 0.726. This proposed test method also was tested by dropping the ball at a height of 3.3 m of drop height and the value of COR obtained ranges between 0.696 and 0.720. The readings obtained is similar to the range obtained by dropping the ball drop between 1 and 3 meter. However, this range of COR is higher as compared to the range of COR calculated based on the free fall first-bounce height data [6] which only ranges from 0.505 to 0.674. This is mainly due to the internal ball sliding friction and the deviation of the ball's rebound trajectory from the vertical line.

CONCLUSION: The coefficient of restitution of a takraw ball for a vertical drop test can be measured in terms of the bounce velocity by using high speed camera. This standard method is easier to set up eliminate the error of result due to the effect the ball rebound trajectory from vertical line and the ball spin due internal sliding friction.

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THE EFFECTIVENESS OF FITT PRINCIPLE IN EXERCISE REHABILITATION FOCUSING ON COMMON SPORTS INJURIES AMONG MALAYSIAN ATHLETES

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INTRODUCTION: Injuries are undesirable and it does not only befall on athletes but also the general public. Nowadays, claims for a quick recovery of injuries are high [1,2,3,5]. Therefore, effective rehabilitation is needed to improve recovery time. Effective rehabilitation can help patients to return to work or play sports again. Injuries that takes longer time to recover can cause an organisation or team system to be disrupted [4,7]. As reported by Andrea Stracciolini et.al [2,6], proper rehabilitation and short periods of time is something to be taken into account in treating sports injuries. Overall in sports rehabilitation, practicing progressive exercises and the use of therapeutic modalities are useful to help patients to achieve full recovery.

METHODS: A holistic approach that combines the use of quantitative and qualitative research was used in this study. Combining these methods produces a better research as it complements the advantages and disadvantages of each method [4,7]. In this study, quantitative design was implemented in advance to get an initial overview of the matter. Subsequent qualitative data serves to verify the findings with deeper insights. In this study, an observation and checklist were used to identify problems of frequency, intensity, time and type (FITT) principle in rehabilitation exercise. The checklist involves 10 Malaysia athletes that underwent the rehabilitation program under National Sports Institute. Additionally, a pilot study was carried out on ten sports science students who had a history undergoing physiotherapy to investigate the cronbach alpha for the reliability of the questionaire. This number between 5 to 10 people was considered by Nick Fox et.al [8] as sufficient for a pilot study. Overall, the reliability of checklist was 0.895. In this paper, the means will be described based on three levels: range 1.00-2.49 (low), 2.50-3.49 (intermediate) and 3.50-5.00 (high).

RESULTS AND DISCUSSION: The highest constraining factor was frequency with mean 2.20 ±0.0894. This was followed by three other factors which were intensity (mean 2.56±0.6547), time (mean 2.96±0.2191) and type (mean 3.72±0.4100). Surprisingly, frequency was the lowest factors, intensity and time factors were at intermediate level except the type of training. The overall total of mean was 2.86±0.3931. This data shows that FITT principle was still not used effectively in rehabilitation exercise. The implementation FITT principle should be used as a whole to get a good impression.

CONCLUSION: This paper raised the question of FITT principle problems in rehabilitation exercise; it also attempted to identify which construct that would optimise the FITT principle outcomes. In conclusion, the findings of the study, answered the question on the effectiveness of the application of FITT principle in rehabilitation exercise. This study also revealed several constraining factors that affect the favourable outcomes of the application of FITT principle in rehabilitation exercise. The findings revealed that the main constraining factors were associated with the lack of knowledge in strength and conditioning principle of FITT variable in the rehabilitation exercise. The study provides several insights as follows: to overcome problems in the application of FITT variable in rehabilitation exercise, the variable need to be developed based on the Periodization under the training theory, and also need to be integrated with the therapeutic exercise modalities. This supports rehabilitation treatment to move towards enhancing the recovery process which is necessary to solve the problem of the recovery period.

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SURFACE EMG-BASED ACTIVITY ANALYSIS ON FOREARM MUSCLE: A METHODOLOGICAL PROPOSAL FOR ERGONOMICS EPIDEMIOLOGY

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ABSTRACT: Muscle pain and tenderness is one of the major problems affected by the forearm muscle during daily cyclic work. The technique of surface electromyographic (sEMG) signal analysis is a powerful, established and useful tool in ergonomic epidemiology since long time. In this paper, we propose a number of general guidelines for the sEMG analysis on human forearm muscle during several working environments. The proposal specifies a standard format for analysing the signal, measuring methods, the influence on electrode placement and inter-electrode distance and other challenges when assessing on the individual. The results obtained are useful for clinicians, electromyographer and researchers, especially those who are working on ergonomic activities.

INTRODUCTION: Ergonomics is mainly projected to present optimal comfort and to avoid any stress, constant worry or injury. It is the relationship between people and their regular job. In addition, it takes into account of the worker's capabilities, competences and limitations in seeking to ensure those tasks, equipment, information and the environment suit each worker. sEMG is a tool that can be valuable in ergonomic studies if it is used correctly and if the associated limitations are appreciated [1, 2]. An understanding of the use of sEMG transcends many areas of knowledge including physiology, instrumentation, recording technology, and signal processing and analysis. This study provides a general overview, so that an appreciation for how these areas interacts and impact on the effective use of sEMG. Forearm or antebrachium muscle is an important area for electromyography signal generation during daily recurring works [3]. This may cause muscle fatigue or less activity. Only few studies have experimented different ergonomic aspects of the forearm muscle with respect of sEMG. As a result our on-going research will identify the muscle activeness of the forearm muscle.

METHODS: A systematic search was carried out on PubMed, Scopus and Google Scholar using the following keywords "EMG", "Electromyography", "Forearm muscle" and "Ergonomics". The main question during the search were, 1) what are the techniques used for analysis the EMG signal ?, 2) what types of work was selected for recording the raw signal ?, 3) what are the normalisation process used for amplitude analysis, and some other EMG signal analysis related topics, like inter electrode distance, anthropometric parameters and biomechanics.

RESULTS AND DISCUSSION: The extensive search from the database shows the following results, 1) signals were taken at maximal and submaximal contractions (different level of contractions), 2) most of the researchers used surface (non-invasive) and Ag/AgCL bipolar electrode, and analysed the effect of enter electrode distance, 3) amplitude and frequency range of the raw EMG signal for sampling and filtering, 4) different mathematical and statistical analysis were used for processing, like root mean square (RMS), mean absolute value (MAV), mean frequency, median frequency, co-efficient variance, linear and non-linear relationship among the parameters, 5) signal were analysed with a certain time frame (moving window, time) and 6) chosen various anthropometric parameters (age, sex etc.). Few articles discusses about the artefacts which includes the changing geometry of muscles with respect to electrodes placement and prospective crosstalk from adjacent muscles in the forearm. It is hoped that this methodological proposal assist researchers to apply sEMG in investigating the forearm muscle in order to develop prosthetic hand control apart from supporting the development of an sEMG-based human-robot interface for assistive and rehabilitation aid.

CONCLUSION: In this paper we report a review of EMG analysis on forearm muscle during working environment. This review is significant as there are comparatively a few number of well-controlled reports on EMG, muscle and ergonomics. It is expected that this article could provide some general guidelines to researches especially from the biomedical community whom are interested in EMG analysis on upper limb muscle (especially forearm) from an ergonomics aspect.

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VIRTUAL PROTOTYPING IN DESIGNING HUMAN COMPATIBLE EXOSKELETON FOR LOWER EXTREMITY REHABILITATION

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INTRODUCTION: Exoskeletons are powered electromechanical structures that are worn by a user and may be categorised depending on its function namely augmentative or assistive exoskeleton. In this study, centres on exoskeletons for rehabilitation purpose which is primarily on its assistive functions. In contrast with normal bipedal robotics, an array of design consideration must be taken into consideration owing to the presence of the human user. These considerations are often biomechanical and requires prior knowledge on the nature of human limbs [1,2]. The design must take into consideration of the limitations, geometry, and the nature of the human limb. In investigating the compatibility of an exoskeleton, some researchers attempted on employing an average value for the dimension of the exoskeleton to enable them to fit into a certain quadrant of human users. The assumption that the majority of the human users fall into this category is nonetheless, flawed as human measurements are never linear in scaling [3]. Therefore a proper solution to this problem is to implement flexible or soft components to the exoskeleton structure so that the human limb will fit with a bit of stretch. This proposition however comes into question on whether this will affect the support loading mechanism of the exoskeleton or any other important characteristics of the exoskeletons such as balance or ergonomics. The traditional route to investigate these effects is usually through the fabrication of a physical prototype. Nevertheless, this route is not cost-effective as there is a possibility that multiple prototypes have to be fabricated before the design issues are addressed. The answer to this predicament is virtual prototyping. Virtual Prototyping is a common method employed in consumer product development. It is a cost-effective method to investigate design flaws as well as product optimisation without the need to fabricate physical prototypes. In the design and development of the mechanical structure of a human compatible exoskeleton, ergonomic factors of the design such as the balance of the exoskeleton frame, weight, strength as well as kinematic compatibility will be the primary concern.

METHODS: A computer-aided design (CAD) model is designed and assembled in Solidworks featuring a two Degree of Freedom (DOF) at the hips and 1 DOF at the ankle and the knee, respectively. The selection of this DOF is based on the minimum required DOF for walking. The material selected for this design is set to Aluminium 7075 for all the frame and joint components. The CAD model is then exported to SimMechanics with all of its data (dimension, size, mass, inertia and joint location) intact. These data will be used to compute the Zero Moment Point (ZMP), a parameter often employed in evaluating balance stability. Gait data from actual gait experiments conducted beforehand [1] is used as an input for the ZMP evaluation. The data consists of joint angles recorded through time. The foot is set as the machine ground as the body weight pivots at the foot during foot propulsion and heel strike stages. The simulation is run iteratively and the position of ZMP through time is plotted on the floor plane. The stability of the design is evaluated based on the position of these points.

RESULTS AND DISCUSSION: The preliminary exoskeleton mechanical design was found to be stable as the location of the ZMP is within the support polygon albeit is shifted slightly inwards. This suggests that the current design would not cause excessive tipping in the frontal and sagittal plane. Further modifications towards the simulation procedure will be performed as the assumption of the foot constantly pivoting on the ground for the whole gait cycle does not represent the actual cycle. The design of the structural frame used in this preliminary study is also oversimplified due to the absence of the auxiliary components. Therefore, future works will take these components into consideration.

CONCLUSION: Although the simulation bears seemingly feasible results, further modifications to the methodology is required to produce a more accurate simulation results.

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THE SIGNIFICANCE OF AUTOMATED SYSTEM DEVELOPMENT FOR ASTHMA DISEASE IN MALAYSIA

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INTRODUCTION: Nowadays, asthma is a disease that has become a public health challenge worldwide. It is estimated that by the year of 2025, the prevalence will increase from the current 300 million to 400 million [1]. The prevalence of asthma in Malaysia is estimated to be 4.2% based on the findings of the Second National Health and Morbidity Survey conducted by the Ministry of Health, Malaysia in 1996 [2]. Annual worldwide deaths from asthma have been estimated to reach 250,000 [3]. This is due to the fact that asthma is mostly under-diagnosed and often not managed optimally [4]. Asthma is also a disease characterised by recurrent attacks of breathlessness and wheezing. Generally, a stethoscope is used in diagnosing and monitoring a patient. There is a growing demand for automatic monitoring of the wheeze in assisting the physicians in diagnosing and monitoring of the patient nowadays due to the increasing number of asthmatic patients. Although the stethoscope is reliable and accurate, there are also some disadvantages in using a stethoscope for auscultation as it is a subjective method that solely depends on the experience, skill and also auditory training of the physician. It also lacks a method of recording, and offers no quantitative description that can be observed for later assessment [6]. Asthma is a disease that cannot be cured but can be controlled. Peak Expiratory Flow rate (PEFR) test will be implemented in controlling asthma, nonetheless this form of test is not be suitable and impractical for children as well as patients with severe asthma.

METHODS: A systematic search of articles published on automated system development for asthma and also studies made on asthma in Malaysia was conducted to promote the significance of automated system development for asthma disease in Malaysia.

RESULTS AND DISCUSSION: There are a large number of research made on the development of an automated system for asthma worldwide and only a few in Malaysia. The earliest research on this subject was reported in 1985, nonetheless, it can be observed that the research is still ongoing especially in developing a system that is ready to be implemented in hospitals. There has yet a standardisation of the system to be developed [5]. Jianmin et al. has successfully developed an automated wearable monitoring system for this disease [7]. The device evaluates the lung sound of patients as well as normal subjects and successfully identifies 85% wheezy samples. The latest clinical study conducted in Malaysia on asthma control was done by Usha et al. [8]. This study was conducted at Greentown Health Clinic, Ipoh by performing the test on 120 patients. The study shows that only 39.2% of the patients were classified as having a control asthma. The study also suggests that the patients were found to have poor asthma control. A further assessment to evaluate this matter was also proposed.

CONCLUSION: This paper successfully reviews the development of an automated system for asthma monitoring. It is hoped that this paper could increase the awareness of the implementation and the development of an automated system for asthma disease in Malaysia. Automated system develop could not only provide quantification of the amount and severity of wheeze present in the clinic, but also at home via tele-monitoring. It also could assist medical personnel as well as asthmatic patients in asthma control. Moreover, this automated system developed can also be used in sports as asthma appears to affect athletes in Malaysia.

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DESIGNING AN OPTIMUM FILTER FOR SURFACE ELECTROMYOGRAPHY SMOOTHING

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INTRODUCTION: Surface electromyography (sEMG) is a technique that measures muscle activities during their contraction. This technique has been widely implemented to control exoskeleton robots for rehabilitation purposes [1-3]. sEMG signal reflects directly the user's muscle in real time and defines his/her intention. However, bio-signals by nature are not stable and are susceptible to noises. In order to reduce the noises in the signal with minimum distortion due to the phase distortion known to transpire in filters, an optimised filter is needed.

METHODS: In this study, we propose a method to design the most effective and the least complex Butterworth filter for sEMG smoothing. The purposes of this investigation is to present a promising method to determine the optimum cutoff frequency and the optimum filter order that ensure signal free distortion.

RESULTS AND DISCUSSION: Table I shows the correlations between the wavelet output at different scales and the Butterworth filter at different order with fixed cutoff frequency. The main findings from Table I shows that wavelet approach at scale six (6) possesses the best correlation to the Butterworth filter response at different orders from 1 to 8. However, when scaling up or scaling down the wavelet levels, it is evident that the correlations slightly diverges from the highest correlations points at scale six. More precisely, the correlation that corresponds to the third order is highest point.

Table 1: correlations between wavelet and Butterworth outputs at different scales/orders

Butterworth order		Wavelet scales				
		4	5	6	7	8
1	Correlation	0.948	0.9851	0.9847	0.9657	0.9393
2		0.9352	0.9862	0.9878	0.9624	0.9339
3		0.9298	0.9847	0.9879	0.9601	0.9315
4		0.9267	0.983	0.9874	0.9587	0.9302
5		0.925	0.982	0.9872	0.958	0.9295
6		0.9237	0.9812	0.9868	0.9575	0.929
7		0.9229	0.9805	0.9866	0.9571	0.9286
8		0.9222	0.9801	0.9864	0.9568	0.9283

From the above table the order of the filter is then selected as third order. Table II illustrates the correlation between the original signal and both wavelet approximation/Butterworth filter output at different cutoff frequencies. From the table, it is noticeable that the both wavelet and Butterworth filter correlation meets approximately at the sixth level and cutoff frequency of 6 Hz.

Table II correlations of the wavelets and Butterworth with respect to the original signal

Wavelet scales/Butterworth cutoff	1	2	3	4	5	6	7	8
Butterworth to original signal	0.5184	0.5799	0.5922	0.5996	0.6051	0.6097	0.6138	0.6178
Wavelet to original signal	0.8891	0.7946	0.7282	0.6725	0.6308	0.6081	0.5893	0.5719

CONCLUSION: In summary, selecting a Butterworth filter with a cutoff frequency of 6 Hz and a filter order of 3 is recommended. The proposed method demonstrates the effectiveness of defining the optimum filter based on wavelet approach for filters.

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DECISION MAKING AND RUGBY SEVENS REFEREE PERFORMANCE

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ABSTRACT: This study aims to examine the decision making by rugby sevens referees and its relationship with referee's performance. It was administered to 132 rugby sevens referee (mean age 33.4 + 1.5 years; 132 males) of the Malaysian Rugby Union (MRU) which have been refereeing in 10 rugby sevens tournament in Malaysia. The Instruments used in this study are Rugby Referee Decision Making Test (r=.74) and Referee Sevens Field Performance Evaluation (r=.94). Descriptive and Inferential statistic (one way ANOVA and Pearson Correlation) were use to analyse data. Decision Making (M= 24.13, SD= 5.24) and performance (M= 136.45, SD= 4.47) identified at a moderate level. Finding indicated no significant differences [F= (3, 128) =.246, p>0.05] in decision making across age level but there are significant differences [F= (3, 128) =63.159, p<0.05] across experience level. Highly experience referees scored significantly higher in all decision making constructs compare to less experience referees. The research finding showed a positive and significant relationship between decision making (r= .61, p<.05) to referee performance. In conclusion, the decision making can help in rugby sevens referees performance and recommended the referee coach to increase the use of decision making in future training and assessment. Researcher should investigate the effectiveness of decision making interventions in enhancing referee performance in the future.

INCREASING HAPPINESS WITH YOGA TRAINING IN INDONESIAN ADULT

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ABSTRACT: This research was designed to test the contribution of yoga meditation to happiness in Indonesian adult. There are 70 adults (50-79 years old ; 7 men and 63 women) from Recreation Center of East Java Province, Indonesia participated in this research. Data collection for happiness using Oxpord Happines Questionnare. Data were analyzed using difference mean pretest and posttest happiness score. The result obtained indicates that: (1) mean pretest happiness score = 55. (2) mean postest happiness score = 125. (3). Mean gain score =65. (4) There was difference adult's happiness between before and after received yoga meditation training. After received yoga meditation training adult's happiness were increased. Adult's happiness increase throught the yoga meditation training because of subject's participation, training methods and training items, with they are interrelated to each other. Yoga meditation make subject relax, having positive emotion, and fully of giving. Yoga exercises are gentle, calm, and at certain times hold instantaneous (static). Yoga focuses on meditation or asceticism activity in which an adults focuses their whole mind to control the five senses and the rest of the body as a whole. Yoga exercises that require silence on the body and mind that led to peace of mind and clarity of mind. That all make adult person being happy.

DEVELOPING THE PSYCHOLOGICAL COMPETENCY ASSESSMENT MODEL TO PREDICT THE ACHIEVEMENT OF INDONESIAN SWIMMING ATHLETES

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ABSTRACT: This study aims to develop an assessment instrument of psychological competency for swimming athletes. Assessment tool for psychological competency aims to evaluate the psychological condition of Indonesian swimming athlete. The assessment tool for psychological competency are based on the psychological aspects that must be possessed by a swimming athlete who has a peak performance.

This type of research is the development research, which is the assessment tool for psychological competency model for swimming athletes. The population being studied was Indonesian swimming athletes and coaches.

The first stage of this research is to identify the psychological aspects that must be possessed by a swimming athlete who has a peak performance. Methods of data collection are using the literature study, the Focus Group Discussion (FGD) and interviews. FGDs and interviews were conducted to swimming athletes and coaches. The results consist of several aspects of mental ability and aspects of personal competency. The aspects of mental abilities consist of self-efficacy, optimism, hope and resilience. While aspects of personal competency consists of self-confidence, motivation of achievement, emotional stability, and self-adjustment.

The result of the study is an assessment tool for psychological competency in evaluating psychological conditions of swimming athlete in order to be able to achieve peak performance. To test the competence of psychological assessment tools for evaluating the psychological condition of the swimming athlete, test is conducted with a panel of coaches swimming athlete.

TALENT IDENTIFICATION OF INDONESIAN INDIVIDUAL 100 METRES SPRINTERS

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ABSTRACT: Sporting talent is a very decisive to improve performance in sports. Coaching performance to effectively need talents identification. This research is motivated by the increasingly performance in sports, especially individual 100 metres sprinter In Indonesia. The purpose of this study are (1) Setting physical factors (anthropometric, biomotoris, physiological) as predictors for identifying talent athletes. (2). Setting psychological aspects as predictors for identifying talent Indonesian individual 100m sprinter. This type of research is the development research, to identify talent of sprinter. The population being studied was Indonesian individual 100 metres sprinter athletes and coaches. Collecting data use literature study, the Focus Group Discussion (FGD), interviews and content validity ratio (CVR) from 8 person experts. The result of study are several anthropometric consist of limb length, range of arms, height, high sitting. Biomotoris consist of leg muscle strength and power. Physiological are of mental ability and aspects of personal competency. The aspects of mental abilities consist of aerobic and anaerobic capacity and VO2 max. Psychological aspects consist of concentration, regulation emotion, self-confidence, and motivation of achievement.

VISUAL BASIC APPLICATION PROGRAM FOR EVALUATION PHYSICAL CONDITIONS OF EAST JAVA FOOTBALL ATHLETES BASED MODEL DISCRIMINANT

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ABSTRACT: This research aims to develop software to evaluate the physical condition of East Java football athletes based discriminant model. The specific objective of this research is to develop software for evaluation of the Visual Basic programming the physical condition of athletes football discriminant analysis based on modelling results. Then test the ability of the software to evaluate the physical condition of football athletes. This type of research is the development of research, make and model of computer programs using the Visual Basic programming language. The study population is the football athlete of East Java U-18, U-21 and U-23. Then do the processing of the data using discriminant analysis. The next step is to make a computer program using Visual Basic programming language based on the discriminant model. The results of this study are discriminant model with variable speed, aerobic endurance, muscular strength arm, leg muscle explosive power, and agility. Then created a visual basic computer program based on the discriminant model and tested the ability of the software to evaluate the physical condition of football athletes named "EKFA–Sepakbola" through test with a panel of football coaches. After tested and declared fit to be used to evaluate the physical condition of the U-18 football athletes. Based on the result, then proceed with developing athletes in the category of U-21 and U-23 in the next year.

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