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CHANGES OF THE BODY COMPOSITION, PHYSICAL PERFORMANCES AND SERUM METABOLITE PROFILE AMONG NOVICE MALE ADOLESCENT FIELD HOCKEY PLAYERS: THE IMPLICATION OF GENETIC AND STRENGTH TRAINING INTENSITY

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ABSTRACT

Studies suggested that genes are one of the contributing factors that affect an athlete's performance, aside from a well-designed training programme. Therefore, training response following different strength training (ST) intensity in individuals with different genotypes profile needs to be explored. This study aimed to investigate the changes in body composition (skeletal muscle mass [SMM], body fat percentage [BF%]), physical performances (upper [UBS] and lower body strength [LBS], lower body power [LBP], percentage of sprint decrement [$\%S_{dec}$], maximal oxygen uptake [VO_2max]), and serum metabolites profile following different ST intensity and genotypes profile. A total of 45 male adolescent field hockey players (age=16.5±0.5 years old, height=1.60±0.5 m, weight=61.0±6.7 kg) were randomly assigned into; 1) high intensity [H] ST (3 sets of 6 repetitions at 80 to 90% 1RM), 2) moderate intensity [M] ST (3 sets of 8 repetitions at 60 to 75% 1RM) and a control group (C) whom did not take part in any ST sessions. Six selected upper and lower body exercise routines were prescribed three times per week for eight weeks, non-consecutively. Pre- (week 0) and post-training (week 9) measures of body composition and physical performances were determined. Participants were genotyped for nine gene polymorphisms; strength-power and endurance: *ACE* (rs1799752), *ACTN3* (rs1815739), *PPARA* (rs4253778), strength-power: *AGT* (rs699), *TRHR* (rs7832552), endurance: *ADRB3* (rs4994), *BDKRB2* (rs1799722), *PPARGC1A* (rs8192678), and *VEGFA* (rs2010963). Subsequently, global metabolomics analysis (liquid chromatography-mass spectrometry) was conducted on 15 participants. The effect of different ST intensities on the changes of body composition and physical performances were examined through one-way analysis of variance (ANOVA). The effect of different genotype profiles and ST intensities on body composition and physical performance changes were examined through a mixed between-within ANOVA. The metabolomics data were analysed using Mass Profiler Professional software and MetaboAnalyst 5.0. The H group shown significantly greater improvement compared to M and C in the body composition (SMM: H=28.80±3.47 to 29.70±3.32 kg, M=27.83±2.89 to 28.21±2.91 kg, C=27.56±2.27 to 27.60±2.26 kg; BF%: H=13.42±2.99 to 12.42±3.03 %, M=15.45±4.39 to 15.02±4.43 %, C=13.04±3.47 to 13.97±3.38 %) and physical performances (UBS: H=44.93±3.84 to 66.80±4.28 kg, M=44.13±3.81 to 60.40±4.73 kg, C=44.13±3.81 to 43.87±4.10 kg; LBS: H= 123.00±11.62 to 165.60±15.77 kg, M=122.33±13.21 to 140.87±10.90 kg, C=118.47±9.08 to 114.00±10.72 kg; LBP: H=4.27±.61 to 5.06±.57 kW, M=3.58±.72 to 4.03±.73 kW, C=3.79±.51 to 3.68±.50 kW; $\%S_{dec}$: H=8.75±1.92 to 7.04±1.82 %, M=9.56±2.35 to 9.23±2.32 %, C=9.25±2.38 to 9.80±2.85 %) except for VO_2max, post-training. The polymorphisms of *ACE* (rs1799752) and *BDKRB2* (rs1799722) exerted significant interaction effect upon LBS, $F_{(4,36)}=4.94$, $p<.05$, $\eta_p^2=0.35$ and UBS, $F_{(4,36)}=6.21$, $p<.05$, $\eta_p^2=0.41$, respectively. Two metabolites (3-O-Sulfogalactoslyceramide, Sphingosine-1-phosphate) significantly differ between training groups and were chosen as the potential biomarkers following ST. In conclusion, prescribing HST resulted in greater body composition and physical performances changes. Moreover, combination of favourable genetic profiles with appropriate training intensity is advantageous to novice adolescent athletes. Finally, metabolome changes offer the identification of metabolite signature following ST.

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CHAPTER ONE
INTRODUCTION

1.1 Background of the Study

1.1.1 Field hockey is an intermittent sport

Field hockey is a popular Olympic sport among the most well-known worldwide sport (Lemos et al., 2017). It is intermittent in nature, involving muscle strength-power for sprinting and a good aerobic capacity (Elferink-Gemser et al., 2004). Field hockey involves 60% aerobic and 40% of anaerobic energy systems (Gronek et al., 2013; Elferink-Gemser et al., 2004). During a competitive field hockey game, the athletes may cover a distance of approximately 8 to 14 km at an average intensity of 85 to 90 % of their maximal heart rate (HR_{max}) or 75 to 80% of their maximal oxygen uptake (VO_2max) with mark differences according to their standard playing position (Bishop & Girard, 2013).

1.1.2 Novice adolescent field hockey players

Malaysia has a large reservoir of sporting talent including athletes already participating in various sports along and undiscovered talents. The primary or secondary school athletes serve as a pool of various sporting talents which are then chosen according to specific selection procedures in The Malaysian Talent Identification (myTID) program, and later trained at a higher level (Wazir et al., 2017). Research consistently demonstrated that athletic excellence requires extensive and organised sport-specific practice and training over the years (Gullich, 2014). Novice and adolescent field hockey players ought to optimally develop their physical abilities to cope with the increasing training demand and matches throughout the season and their sporting career (Sharma & Kailashiya, 2018). The combination of appropriate training dosage with other associated factors created a solid foundation for excellent, high-performance athletes (Lemos et al., 2017).