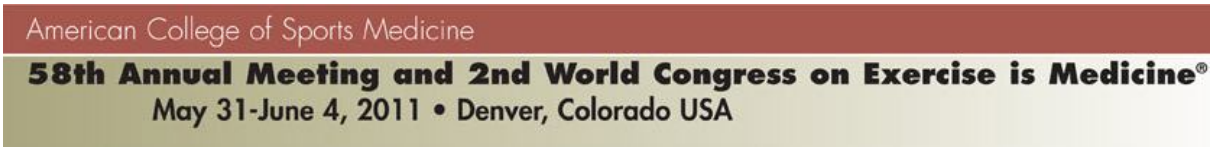
教育部補助國內大學校院博士班研究生出席國際會議報告

2011 年 06 月 9 日

報告人姓名	黃依婷	就讀學校系所及年級	中國文化大學體育學系運動教練研究所博士班二年級
會議期間及地點	2011/05/31-2011/06/04 Denver, CO, USA	本部核定補助文號	100 年 5 月 12 日 臺文(一)字第 1000081184 號
會議名稱	(中文) 第 58 屆美國運動醫學年會會議 (英文) 58th Annual Meeting of the American College of Sports Medicine		
發表論文題目	(中文) 優秀舉重、游泳及長跑選手身體組成及血脂肪之比較 (英文) Comparison of Body Composition and Lipid Profile among Elite Weightlifting, Swimming and Running Athletes		

壹、會議介紹

美國運動醫學年會 (Annual Meeting of the American College of Sports Medicine)是運動科學、生理學、臨床醫學、復健、適應體育、運動器材等領域最重要也最大型的國際學術會議。每年吸引超過 3000 篇的論文投稿，世界不同國家及地區的相關領域學者、研究生、廠商參與。會中除了正式的口頭及海報學術發表外，亦舉辦多場專業演講，以及優秀學者紀念講座。另有 Student Bowl，讓美國各校運動科學領域的大學生齊聚一堂互相較勁科學基礎知識。



貳、重要活動內容與心得 (參加會議經過及與會心得建議)

一、參加會議經過

（一）Exercise is Medicine

美國運動醫學年會開幕前一日，一整天都是到場註冊，拿取會議資料的時間。下午 1:45-2:45，是 Exercise is Medicine 的世界大會，針對身體活動促進健康的各項最新資訊整理成基本方針，並於此期間發表。下午 3:00-5:00 則是 Exercise is Medicine 的相關演講，晚上 6:00-9:00 是 Exercise is Medicine 的開幕會及內容展示。

（二）6 月 1 日

一早是運動醫學會會員的會議，早上第一場演講是 Joseph B. Wolffe 的紀念演講。懷念 Joseph 學者對於運動醫學學術領域的貢獻。接著整天的行程，學者、學生們的學術發表陸續開始，並在各廳依照發表類型同時進行。下午 1:30-6:00，展示廳開幕，許多的運動科學儀器、運動營養廠商、最新研發的運動器材相關廠商，匯聚一堂，在海報發表的大廳旁，提供展示和說

明。當日晚上還有 Student Bowl，提供一個讓美國各地的大學生，組成競賽隊伍，在 ACSM 的會場較勁運動科學知識。

（三）6 月 2 日

早上 8:00 到下午 5:15，是一連串的科學及臨床會議發表，來自世界各國的運動醫學會會員、學者、學生們，在今日齊聚一堂，共襄盛舉。

（四）6 月 3 日

本日的早上，有項特別的活動：11th Annual Gisolfi Fun Run，是紀念愛荷華州大的 Gisolfi 教授而舉辦的健康路跑。早上 8:00 到下午 5:15，仍延續昨天的科學及臨床發表時程。10:30-11:45 則有 D. B. Dill 的紀念講座。中午 12:00-12:45 是世界各國的學生會議。晚上 7:00-10:00 則是大會主辦的雞尾酒會。

（五）6 月 4 日

本日的學術發表行程安排在早上 8:00 至 11:00。接著中午是 ACSM 理事長的演講及閉幕儀式，下午 1 點為研討會後的超音波介紹。

二、與會心得

今年是第二次參加 ACSM 年會，比起第一年，多了幾分沉穩，但期待和興奮卻沒因為是第二次參加而減少。今年，自己的發表是分配在 6 月 4 日早上 8:00 的 poster presentation。美國的海報發表版面比台灣的大很多 (240 cm x 120 cm)，還特別印製了大張海報以配合大會提供的版面。

（一）5 月 31 日(Exercise is Medicine)

本日是世界各國的學者、學生及教授們現場註冊的日子，下午則有「運動即良藥」(Exercise is Medicine, EIM)的系列活動及演講。美國運動醫學會的宗旨，為推廣適當的身體活動，以促進全人健康、增進生活品質。會中也

提供了 2011 Fitness index 的抽印本，提供美國各州的體適能調查資料及比較。在了解美國國民健康概況與身體活動量上，提供了許多有意義的參考。在此 EIM 的開幕會上，學者們分享 EIM 的工作如何在美國及世界各國繼續推行的意見。

（二）6 月 1 日

早上第一場演講是 Joseph B. Wolffe 的紀念演講，Joseph 是 ACSM 的第一屆理事長，此演講的宗旨是藉由該年度演講者的相關演講議題及學術研究趨勢介紹，懷念 Joseph 學者對於運動醫學學術領域的貢獻。本屆演講者為 Juleen R. Zierath 博士，演講題目為 Health Promoting Effects of Exercise in Diabetes and Obesity: Translating Basic Science into Preventive Action and Treatment. Zierath 博士將困難的分子訊息傳遞觀念能讓非分子的生物學家、生理學家及臨床醫生們能夠了解。並發表了 145 篇有 peer reviewed 的原創性論文，以及 50 篇的綜評性論文。接下來，AM9:30-PM5:15，即是世界各國共襄盛舉的學術發表時間。海報、口頭發表依論文類型分區及分段安排發表時間及場地。由於數量眾多，幾乎同時段皆有數十場的口頭發表同時進行，海報發表則是安排作者以一個半小時的時間，在海報旁等待，介紹及與參與者交流。由於自己的海報是最後一天(6 月 4 日)發表，因此，有了足夠的時間觀摩其他的發表者，如何應對及介紹自己的研究。

（三）6 月 2 日至 6 月 4 日

這幾日最大的時間規劃，即是科學及臨床的學術發表，三天中，超過 400 個分類會議，發表論文篇數高達 3274 篇，規模之大、參加者之眾，實難想像，卻也因此充分了體會了國際學術交流的重要意義。

6 月 3 日早上 6:30，是第 11 屆 Annual Gisolfi Fun Run，為紀念愛荷華州立大學的 Gisolfi 教授所舉辦的路跑競賽。Gisolfi 教授是我的碩士班教授在愛荷華州大求學時的指導教授，本次的路跑參加起來特別有意義。

6 月 4 日早上 8:00，我的海報發表時間，會中遇到許多台灣的老師、前輩們，

也碰到了對我的研究有興趣的外國學者。再共同的興趣下，語言隔閡似乎就沒那麼大。也接受了不少十分有幫助的指教。

三、建議

一年一度的美國運動醫學年會，是運動科學、生理學、臨床醫學、復健、適應體育等領域的學術重要代表會議，每年在美國各地輪流進行。本次雖第二次參加，但受到的啟發則一次比一次大。台灣的學生能有這樣機會參與這種學術研討會的機會不多，若能提供更多的經費和機會，多鼓勵學生參與，相信對台灣未來走向國際學術發展的願景會更有幫助。

四、攜回資料名稱及內容

（一）ACSM Final Program (美國運動醫學年會會議手冊)

（二）2011 American Fitness Index

（三）ACSM Today (5/31-6/4 每日一份)

（四）ACSM Exhibit Guide

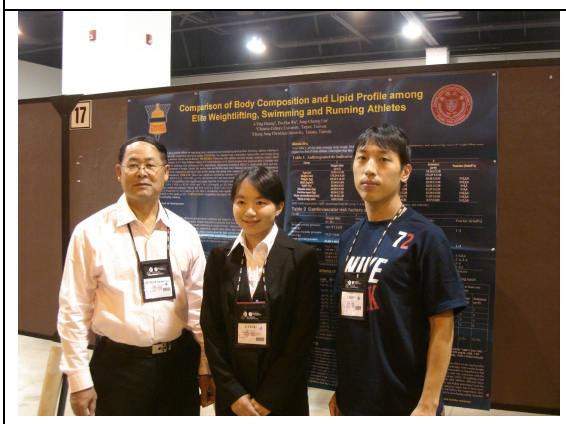
（五）1st Announcement ROMA 27-30 September 2012 XXXII world Congress of Sports Medicine

（六）Annual meeting and 2nd world congress on exercise is medicine May 31-June 4, 2011 Denver, Colorado Exhibit Guide Addendum

（七）MedlinePlus for Health Professionals—Trusted Health Information for You

（八）American College of Sports Medicine 58th Annual Meeting and 2nd World Congress on Exercise is Medicine-- Silent Aduction Guide

五、會議相關照片

	
會議中心周邊街道的關東旗	會場大廳
	
會員註冊處	運動科學影片 DVD 展示及販賣
	
文大運教所師生(左起林正常教授、黃依婷博士生、蔡政霖博士生)	文大運教所師生攝於科羅拉多會議中心前

叁、結語

五天的會議，過得充實又富收穫。認識了來自世界各國的學者和朋友，也從各類的演講及發表中了解目前運動科學的研究趨勢。

發表論文全文：

Comparison of Body Composition and Lipid Profile among Elite Weightlifting, Swimming and Running Athletes

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[1]Chinese Culture University, Taipei, Taiwan.
[2]Chang Jung Christian University, Tainan, Taiwan.

Abstract

Regular exercise training has been proved to have positive effects on regulating body composition and normalizing lipid profiles. However, athletes adapting to different training status may result in different body composition and lipid profile.

PURPOSE: To compare body composition, lipid profile, and resting blood pressure among weightlifters, swimmers, long distance runners and sedentary.

METHODS: Thirty-nine elite athletes and nine healthy sedentary (males, 18-25 years) were recruited (weightlifters, n=11; swimmers, n=12, long distance runners, n=16 and sedentary, n=9). Blood pressure was measured after 15-minute rest. Fasting venous blood samples were collected for analyzing total cholesterol (TC), high-density lipoprotein cholesterol (HDL-C), triglyceride (TG) and low-density lipoprotein cholesterol (LDL-C). Measurements of weight, %body fat, muscle mass and fat-free mass were obtained via multi-frequency bioimpedance analyzer. The correlations and differences of body composition and blood lipid profile among each group were examined by using Pearson product-moment correlation method and one-way ANOVA, respectively.

RESULTS: There were significant correlations between %body fat and waist circumference (WC), systolic blood pressure, TG, TC, TC/HDL-C and LDL-C ($r = 0.35\sim0.81$, $p<.05$), and between WC and mean arterial pressure (MAP), TG, TC,TC/HDL-C and LDL-C ($r = 0.39\sim0.73$, $p<.05$). BMI and LDL-C of weightlifters were significantly higher than that of swimmers and runners (BMI: 27.64 ± 4.84 v.s. 21.64 ± 1.74 and 19.84 ± 0.81 kg/m^2, $p<.05$; LDL-C: 114.11 ± 33.85 v.s. 82.38 ± 20.61 and 77.34 ± 12.99 mg/dL, $p<.05$). Percentage body fat and TC of weightlifters were significantly higher than that of swimmers, runners and sedentary (%body fat: 20.90 ± 6.35 v.s. 13.84 ± 4.55, 12.59 ± 1.17 and 16.91 ± 5.58%, $p<.05$; TC: 190.00 ± 39.76 v.s. 157.92 ± 24.07, 158.56 ± 14.35 and 153.11 ± 15.51 mg/dL, $p<.05$). HDL-C of sedentary were significantly lower than that of swimmers and runners (50.89 ± 7.98 v.s. 68.75 ± 13.57 and 69.81 ± 13.21 mg/dL, $p<.05$).

CONCLUSION: Weightlifters had higher %body fat, resting blood pressure and worse blood lipid profile than swimmers, runners and healthy sedentary.

Keywords: blood lipid, percentage body fat, blood pressure

Introduction

It is well established that physical activity is exerts beneficial effects on several chronic conditions and longevity, on the basis of its proposed biological effects, especially on lipid profiles (Lippi et al, 2006). Although athletes have active lifestyle, they have to modulate their food intake and the type of body build to fit for their specific sports. For instance, weight lifters have to keep their body weight conforming to weight division. Athletes adapting to different training status may result in different body composition and lipid profile. With regard to body composition, studies have shown that body fat is associated with serum lipid concentrations (Katzmarzyk et al, 2001; Liu, Chiou, and Wu, 2002). However, little is known about the high exercise training-induced modifications of plasma lipids and lipoproteins that occur in professional endurance athletes. This study recruited elite weightlifting, swimming and long distances running athletes. Specific training of weightlifting consist of large amount of resistance exercise. Swimmers didn't need too much muscles in order to keep their buoyancy. Besides, Low body fat and thin somatotype is suitable for long distance runners. It's interesting to see whether the training status affected their blood lipid profile.

Methods

Subjects: There were 36 elite male athletes and 9 sedentary enrolled in this study (18 to 25 years of age), athletes including 11 weight lifters, 12 swimmers, 16 long distance runners. All athletes have trained five days a week, 3 hours per training, and engaged in their sports over 7 years. Sedentary participants took physical activity less than one day per week, and didn't take any physical program at least for the previous 6 months. Their lifestyle were sitting most of a day and inactive. None of the subjects were taking medications and have smoking habits. All participants were given verbal and written information about the objectives and procedures of the study. Written consent to participate was obtained before data collection. The study was reviewed and approved by the institutional review board.

Blood collection: Blood samples were drawn in the morning (7:00-9:00 AM) after a 12 h fast from an antecubital vein into vacutainer tubes containing heparin lithium salt. Blood was immediately placed on ice, then centrifuged at 1,500 g for 15 minutes. Blood plasma was drew 250μ*l* into microtube of automated analyzer for clinical chemistry SPOTCHEM EZ SP-4430, analyzing for plasma triacylglyceride, total cholesterol, and high-density lipoprotein cholesterol. Low-density lipoprotein cholesterol was calculated according to formula (Friedewald, Levy, and Fredrickson, 1972) :

$$[\text{LDL-C}] = [\text{TC}] - [\text{HDL-C}] - ([\text{TG}]/5)$$

Body composition: Measurement of body weight, percentage body fat and fat-free mass were obtained via InBody3.0 multi-frequency bioimpedance analyzer (Model: MF-BIA8; Inbody 3.0, Biospace, Korea).

Anthropometric indicators: Waist and hip circumference were measured using a measuring tape. Waist measurement was made halfway between the lower border of the ribs, and the iliac crest in a horizontal plane. Hip circumference was measured at the widest point over the buttocks (Dalton et al, 2003). According to Anthropometric Standardization Reference Manual (Callaway, 1988), waist and hip circumferences were measured three times, measuring errors were within 1 cm, and mean values were adopted. If measuring errors were above 1 cm, the measurement should repeat itself. The mean of the three closest measurements was calculated.

Blood pressure: Sitting blood pressure was measured after 15 minutes of rest were measured by automatic blood pressure monitor (OMRON HEM-7011) with inflating cuff around the dominant upper arm. Blood pressure was measured twice, if the variation between the measurements was greater than 10 mmHg, continued resting 5 minutes, than a third measurement was taken, until the variation smaller than 10 mmHg. The average of two measurements was employed in the analyses.

Statistics analysis

Data were analyzed using SPSS software (Version 12.0; SPSS Inc, Taiwan). The correlations and differences of body composition, blood lipid profiles and all the variables of each group were examined by using Pearson product-moment correlation method and one-way ANOVA, respectively. If a significant difference was obtained, a Tukey post hoc test was used to compare the differences among each group. All statistical tests were two-sided. A level of statistical significance at $p<.05$ was used in all analyses.

Results

From table 1, all the items (average body weight, BMI, %BF, muscle mass, fat-free mass, waist circumference, and waist-to-hip ratio) of weight lifters were higher than that of other athletes, even higher than that of sedentary.

Table 1 Anthropometric indicators among each groups

Group	1	2	3	4	
	Weight lifter (n=11)	Swimmer (n=12)	Runner (n=16)	Sedentary (n=9)	Post-hoc (Scheff'e)

Age (yr)	19.91 ± 1.30	19.00 ± 0.95	19.81 ± 1.47	19.56 ± 2.19	
Height (cm)	173.24 ± 4.28	176.83 ± 4.73	175.31 ± 4.45	173.67 ± 5.34	
Weight (kg)	83.25 ± 16.15	67.57 ± 4.32	60.95 ± 2.94	66.88 ± 8.93	1>2,3,4
BMI (kg/m^2)	27.64 ± 4.84	21.64 ± 1.74	19.84 ± 0.81	22.24 ± 3.46	1>2,3,4
%BF (%)	20.90 ± 6.35	13.84 ± 4.55	12.59 ± 1.17	16.91 ± 5.58	1>2,3
Muscle mass (kg)	60.99 ± 7.50	55.04 ± 4.46	49.83 ± 2.08	51.87 ± 6.24	1>3,4
Fat-free mass (kg)	65.04 ± 7.93	58.20± 4.67	53.26 ± 2.20	55.34 ± 6.65	1>2,3,4
Waist circumference(cm)	84.46 ±11.48	70.28± 3.26	68.76 ± 2.71	71.97 ± 8.93	1>2,3,4
Waist-to-hip ratio	0.83 ± 0.05	0.78 ± 0.03	0.76 ± 0.03	0.77 ± 0.05	1>2,3,4

BMI: body mass index; %BF: percentage body fat; group 1~4 means weight lifters, swimmers, runners, and sedentary.

In table 2, resting systolic pressure and mean arterial pressure of weight lifters were significantly higher than tthat of runners (p<.05). Total cholesterol of weight lifters were significantly higher than that of the other groups (190.00 ± 39.76 v.s. 157.92 ± 24.07, 158.56 ± 14.35, 153.11 ± 15.51 mg/dL, p<.05). Plasma HDL of sedentary were significantly lower than that of swimmers and runners respectively (50.89 ± 7.98 v.s. 68.75 ± 13.57 and 69.81 ± 13.21 mg/dL, p<.05). TC/HDL of weight lifters were significantly higher than that of runners (3.28 ± 1.04 v.s. 2.34 ± 0.43); Plasma LDL of weight lifters were higher than that of swimmers and runners respectively. (114.11 ± 33.85 v.s.82.38 ± 20.61 and 77.34 ± 12.99 mg/dL, p<.05).

Table 2 Cardiovascular risk factors among each groups

Group	1	2	3	4	
	Weight lifter (n=11)	Swimmer (n=12)	Runner (n=16)	Sedentary (n=9)	Post-hoc (Scheff'e)
Resting systolic pressure (mmHg)	130.73 ± 14.55	118.92 ± 8.35	108.44 ± 8.84	119.11 ± 13.15	1>3
Resting diastolic pressure (mmHg)	71.27 ± 8.81	64.08 ± 5.25	63.56 ± 7.57	70.22 ± 12.58	
Mean arterial pressure (mmHg)	90.89 ± 10.24	82.18 ± 5.07	78.37 ± 7.56	86.36 ± 12.47	1>3
Triglyceride (mg/dL)	76.27 ± 62.69	47.25 ± 34.12	57.06 ± 36.48	64.56 ± 20.21	
Total cholesterol (mg/dL)	190.00 ± 39.76	157.92 ± 24.07	158.56 ± 14.35	153.11 ± 15.51	1>2,3,4

HDL (mg/dL)	60.64 ± 13.17	68.75 ± 13.57	69.81 ± 13.21	50.89 ± 7.98	2>4, 3>4
TC/HDL	3.28 ± 1.04	2.50 ± 0.67	2.34 ± 0.43	2.86 ± 0.52	1>3
LDL (mg/dL)	114.11 ± 33.85	82.38 ± 20.61	77.34 ± 12.99	85.76 ± 20.51	1>2,3

HDL: high-density lipoprotein cholesterol; TC/HDL: total cholesterol/ high-density lipoprotein cholesterol; LDL: low-density lipoprotein cholesterol

There were significantly positive relationships between %BF and blood lipid profile (TC, TG, LDL, TC/HDL) (p<.05), besides of HDL. (Table 3). Systolic blood pressure was significantly relative with BMI, %BF, WC, and WHR (p<.05).

Table 3 correlations of body composition and lipid profile

	age	height	weight	BMI	%BF	Muscle mass	FFM	WC	WHR
BMI	-.025	-.226	.954(**)	1					
%BF	.091	-.211	.776(**)	.821(**)	1				
Muscle mass	-.080	.241	.916(**)	.821(**)	.468(**)	1			
FFM	-.072	.231	.920(**)	.828(**)	.474(**)	.999(**)	1		
WC	.050	-.105	.942(**)	.953(**)	.814(**)	.804(**)	.812(**)	1	
WHR	.090	-.275	.724(**)	.790(**)	.629(**)	.610(**)	.612(**)	.860(**)	1
SBP	-.086	.156	.537(**)	.485(**)	.355(*)	.519(**)	.520(**)	.473(**)	.431(**)
DBP	.106	.082	.263	.236	.180	.239	.248	.278	.271
MAP	.025	.121	.406(**)	.365(*)	.272	.383(**)	.389(**)	.386(**)	.362(*)
TG	.093	-.134	.372(**)	.417(**)	.346(*)	.263	.269	.462(**)	.500(**)
TC	.049	-.004	.545(**)	.552(**)	.487(**)	.431(**)	.438(**)	.546(**)	.415(**)
HDL	-.170	.102	-.308(*)	-.327(*)	-.238	-.282	-.287(*)	-.340(*)	-.330(*)
TC/HDL	.232	-.113	.653(**)	.680(**)	.570(**)	.540(**)	.550(**)	.727(**)	.608(**)
LDL	.150	-.030	.647(**)	.654(**)	.551(**)	.544(**)	.553(**)	.660(**)	.498(**)

FFM: fat free mass; WC: waist circumference; WHR: waist to hip ratio; SBP: systolic blood pressure; DBP: diastolic blood pressure; MAP: mean arterial pressure; TG: triglyceride

Regard to human health, undesirable level of cardiovascular risk factor for men displayed following:
%BF > 25%, WC > 90cm, WHR >0.9, TG >150 mg/dL, TC >200 mg/dL, HDL-C < 40 mg/dL, TC/HDL > 4.5, and LDL-C >129 mg/dL, beyond these cut-points regard as undesirable cardiovascular risk factors. In this study, there were six weightlifters who had at least one cardiovascular risk factor in all eleven weightlifting subjects, divided the ratio was 54.5%. In swimmer, runner, and sedentary group, the ratio of subjects with one or more CVD risk

factors to subjects number of each group were 16.7%, 6.2%, and 33.3%, respectively. Besides, regard to twelve weightlifters, there were five athletes whose %BF>25%, five had waist circumference higher than 90 cm, four had TC higher than 200 mg/dL, and three had LDL-C higher than 120 mg/dL. (data not shown).

Table 4 Number of undesirable cardiovascular risk factors among each group

Number of undesirable cardiovascular risk factors	**Number of people who had at least one CVD risk factor in each group**			
	Weightlifter (n=11)	Swimmer (n=12)	Runner (n=16)	Sedentary (n=9)
1 factor	1	2	1	3
2 factors	3	0	0	0
3 factors	1	0	0	0
>4 factors	1	0	0	0
percentage of subjects with one or more CVD risk factors	54.5%	16.7%	6.2%	33.3%

undesirable level of cardiovascular risk factor: %BF > 25%, WC > 90cm, WHR >0.9, TG >150 mg/dL, TC >200 mg/dL, HDL < 40 mg/dL, TC/HDL > 4.5, and LDL >129 mg/dL;
CVD: cardiovascular disease

Discussions

Results of our investigations confirmed that vigorous and regular aerobic training which long distance runners engaged in elicits a combined favorable effect on the lipid profile, especially plasma high density lipoprotein cholesterol. In this study, plasma HDL-C of swimmers and runners were significantly higher than that of sedentary with similar height, weight, and BMI. Considering that an acute bout of swimming exercise elevates HDL-C levels following exercise (Ohkuwa & Itoh, 1993), it is reasonable to hypothesize that regular (repeated bouts of swimming) would chronically increase HDL-C concentrations similar to other land-based exercise (Durstine et al, 2002), that was consistent with the present study, HDL-C of swimmers and runners are similar, and higher than recommended value (>40mg/dL). (National Cholesterol Education Program, 2002). Weightlifters had higher resting systolic blood pressure (within the normal blood pressure) than runners, and had higher plasma LDL-C and total cholesterol than other athletes, although these values didn't beyond the

recommended values. This results may due to their higher body weight (83.25 ± 16.15 vs. 67.57 ± 4.32 and 60.95 ± 2.94) and higher percentage body fat (20.90 ± 6.35 vs. 13.84 ± 4.55 and 12.59 ± 1.17 %) than swimmers and runners. The reason behind this result may due to their training and nutrition status, but it need more researches. Weightlifters engaged in intensive resistant weight training, and needed to gain their fat free mass to enhance their muscle strength, but before the competition, they often lost weight, using rapid weight reduction methods in order to qualify for a certain weight classification. Under these conditions, the potential for developing eating disorders seems apparent. Suggest that future investigation could focus on athletes nutrition status.

In conclusion, weightlifters had higher percentage body fat, resting blood pressure and worse blood lipid profile than swimmers, runners and healthy sedentary.

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