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Practices and Awareness of Ergogenic Aids Related To Physical Fitness and Blood Lipid Profiles of Regular Fitness Center Users

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Abstract: *The mass of data on understanding health and the importance of physical activity has resulted in increased numbers of fitness center attendees and supplemental dietary intake or use of ergonenic aids in the past ten years. Malaysia, however, lacks data on the awareness and practices of ergogenic supplementation. Hence, this research was undertaken to investigate the pattern of ergogenic aid intake and to compare the blood lipid profiles of users and non users of ergogenic aids among regular fitness centre attendees in Malaysia. Three types of assessments were used: (i) a questionnaire consisting of two sections with categorical and numerical scales to assess practices and awareness; (ii) anthropometry, which included four major components, namely, body composition, cardio-respiratory and muscular endurance, and muscular flexibility assessments that provided data on the level of fitness; (iii) a biochemical assessment of blood lipid profiles (Total cholesterol, HDL-c, LDL-c and TG) using the CardioCheck Portable Analyzer. The present study found that fitness levels demonstrated no significant difference between users and non users of ergogenic aids (t =1.246, p = 0.216). However, blood lipid profiles showed significant differences between users and non users of ergogenic aids (t = -1.224, p = 0.022). Results also showed insignificant relationships (r) between ergogenic aid intake and blood lipid profiles as well as in levels of physical fitness.*
Keywords: *Ergogenic aids, fitness level, blood lipid profile*

I. Introduction

Nutrition and health are self-related and have led many to wiser management of dietary intake and physical activity [1]. There was an increase in the number of fitness centre attendees globally by approximately ten percent over three years [2]. In addition, the use of ergogenic supplements has been documented to also have substantially increased over ten years [3]. An ergogenic aid is defined as any means that enhances energy production and utilization. These may be classified into five categories including mechanical aids, psychological aids, physiologic aids, pharmacological aids, and nutritional aids. The last category is of greater interest [4]. Furthermore, nutritional ergogenic aids can be referred to as any substance that enhances performance. These are either nutrients, metabolic by-products of nutrients, food or substances commonly found in foods that are provided in concentrated forms, more so than in the natural food supply [4].

Initially, ergogenic aids were used by athletes for performance improvement and such use is currently widespread [5]. Nevertheless, the greater use of these aids is by recreational bodybuilders who take them for cosmetic purposes and use them continuously in order to maintain their effects [6]. Nutritional supplements are also considered legal ergogenic aids [7] and though researchers disagree over their effectiveness, people still consume certain nutritional aids in order to increase fitness levels and performance [8].

However, in order to attain and maintain a reasonable healthy standard of fitness, only moderate physical activity is required, but to attain any increase in a desired physical fitness standard, aerobic activities are required [9]. Thus, by using ergogenic aids such as protein supplements, hypertrophic responses can and do occur more immediately, but when they are stopped a process of atrophy rapidly sets in giving cause for continuous consumption [5].

On the other hand, it has been reported that extensive (intense) exercise programs help reduce blood lipid levels even without the use of ergogenic aids [10]. The intake of supplements such as protein also help reduced HDL and LDL levels as reported by a review of four meta analyses [11]; [12]; [13]; [14].

This study attempts to show the use and awareness of ergogenic aids among fitness centre attendees and compare their present fitness levels with standardized physical fitness levels. The study also compares differences between blood lipid profiles of attendees of both users and non-users of ergogenic aids and the relationship(s) of supplements with usage and other factors.

II. Methodology

A sample size is that sample taken from a population in order to represent the entire population of subjects of interest. Respondents in this study are fitness center or gym attendees who either take ergogenic aids

or do not. A study on the physical activity patterns and energy expenditure of Malaysian adults [15] had classified 16% of men and 10% of women as active physically with a total of 26% respondents characterized as 'physically active'. Hence, in this study, twenty-six percent of four-hundred respondents were selected, equaling one-hundred-and-four respondents, of which fifty-two were users and fifty were non-users of ergogenic aids.

Three methods were applied in this study. First was a self-administered questionnaire which each respondent was asked to complete. The source of this questionnaire was a modified from an established query into attitudes from the book *Principles and Labs for Physical Fitness* [16]. Most questions were of a close-ended type with scaled categories using multiple items to elicit a single response with a numerical scale similar to the semantic differential scale numbering from 5 – 7 points. A total of 104 self-administered questionnaires were distributed among fitness center attendees comprising fifty-two users and fifty non-users of ergogenic aids in Johor and Selangor via direct approaches to respondents. Approval from the owner of the fitness centre was obtained and the questionnaire was handed to the subjects. Questionnaires were collected and checked before proceeding with the next phases of the analysis, anthropometry and biochemical.

Four major components were assessed in the second phase, anthropometry for body composition, muscular endurance, muscular flexibility and cardio-respiratory endurance. These four components were crucial for the determination of individual physical fitness [16]. The Bioelectrical Impedance Analysis (BIA) was used to assess body composition, which is a simple technique to administer with moderate accuracy as follows. Several sensors were applied to the skin and a weak electrical current was conducted through the body to estimate body fat, lean body mass and water content. The method is based on the principle that fat tissue is a less efficient conductor of electrical current than is lean tissue. Thus, respondent weight, height, body mass index and percent of body fat were assessed after recording gender, age and height data from the questionnaire, which were then keyed into the BIA before recording respondent weight, BMI and percent body fat. Data so obtained was then recorded on the assessment form. Scientific evidence indicates significant increase in risks for disease when the BMI exceeds 25 [17].

Thirdly, cardio-respiratory endurance was determined by measuring the maximum amount of oxygen the human body utilizes per minute of physical activity. Subjects choose one of three types of exercises depending on time, equipment and individual physical limitations. For the 1.5 mile run and 1.0 mile walk tests, the required equipment included a stopwatch and track or premeasured course, as well as a bench or 16 ¼ inch high gymnasium bleacher. For the muscular endurance test, three exercises were performed to identify a fitness category, including bench jumps, chair dips (for men) or modified pushups (for women), and the abdominal curl/crunch. Equipment needed for bench jumps and chair dips are a bench or 16 ¼ inch high gymnasium bleacher and stopwatch. Modified pushups did not require special equipment and the abdominal curl/crunch needed only strips of cardboard as markers [16]. The maximal amount of oxygen the human body is able to utilize per minute of physical activity is measured as VO_{2max}, and is expressed in liters per minute (l/min) or millimeters per kilometer per minute (ml/kg/min) [16]. According to performance time, VO_{2max} can be determined by referring to Table 1.

Table 1: Cardio-respiratory Endurance (VO_{2max}) Based on Performance Time

Time	VO_{2max} (ml/kg/min)	Time	VO_{2max} (ml/kg/min)	Time	VO_{2max} (ml/kg/min)
6.10	80.0	10.30	48.6	14.50	34.0
6.20	79.0	10.40	48.0	15.00	33.6
6.30	77.9	10.50	47.4	15.10	33.1
6.40	76.7	11.00	46.6	15.20	32.7
6.50	75.5	11.10	45.8	15.30	32.2
7.00	74.0	11.20	45.1	15.40	31.8
7.10	72.6	11.30	44.4	15.50	31.4
7.20	71.3	11.40	43.7	16.00	30.9
7.30	69.9	11.50	43.2	16.10	30.5
7.40	68.3	12.00	42.3	16.20	30.2
7.50	65.8	12.10	41.7	16.30	29.8
8.00	65.2	12.20	41.0	16.40	29.5
8.10	63.9	12.30	40.4	16.50	29.1
8.20	62.5	12.40	39.8	17.00	28.9
8.30	61.2	12.50	39.2	17.10	28.5
8.40	60.2	13.00	38.6	17.20	28.3
8.50	59.1	13.10	38.1	17.30	28.0
9.00	58.1	13.20	37.8	17.40	27.7
9.10	56.9	13.30	37.2	17.50	27.4
9.20	55.9	13.40	36.8	18.00	27.1
9.30	54.7	13.50	36.3	18.10	26.8
9.40	53.5	14.00	35.9	18.20	26.6
9.50	52.3	14.10	35.5	18.30	26.3

10.00	51.1	14.20	35.1	18.40	26.0
10.10	50.4	14.30	34.7	18.50	25.7
10.20	49.5	14.40	34.3	19.00	25.4

Lastly, VO_{2max} was obtained by comparing data of subjects with predicted maximal oxygen uptake for the each test (Table 2) to assess the fitness level based on VO_{2max} by each respondent.

Table 2: Fitness Classification Based on VO_{2max}

Gender	Age	Poor	Fair	Average	Good	Excellent
Men	<29	<24.9	25 – 33.9	34 – 43.9	44 – 52.9	>53
	30 – 39	<22.9	23 – 30.9	31 – 41.9	42 – 49.9	>50
	40 – 49	<19.9	20 - 26.9	27 – 38.9	39 – 44.9	>45
	50 – 59	<17.9	18 – 24.9	25 – 37.9	38 – 42.9	>43
	60 – 69	<15.9	16 – 22.9	23 – 35.9	36 – 40.9	>41
	>70	<12.9	13 – 20.9	21 – 32.9	33 – 37.9	>38
Women	<29	<23.9	24 – 30.9	31 – 38.9	39 – 48.9	>49
	30 – 39	<19.9	20 – 27.9	28 – 36.9	37 – 44.9	>45
	40 – 49	<16.9	17 – 24.9	25 – 34.9	35 – 41.9	>42
	50 – 59	<14.9	15 – 21.9	22 – 33.9	34 – 39.9	>40
	60 – 69	<12.9	13 – 20.9	21 – 32.9	33 – 36.9	>37
	>70	<11.9	12 – 19.9	20 – 30.9	31 – 34.9	>35

The muscular flexibility test consists of three exercises: sit and reach, body rotation and shoulder rotation. The equipment needed is a measuring tape and a stick. Prior to the test, subjects must warm up properly and shoes must be removed. Subjects sit on floor with hips, back and head against a wall, legs fully extended with a measuring tape attach to the floor and soles of both feet. Placing their hands one on top of the other and reaching forward as far as possible, without letting head or back leave off contact with the wall, the beginning of the measuring tape is held at the end of the hand. Both head and back can leave off contact with the wall as the subject gradually reaches forward three times. On the third stretch, they reach forward as far as possible and hold the final position for two seconds. Precautions must be taken to assure the backs of knees remain flat against the floor. The final number of inches reached to the nearest ½" is then recorded and referred to respective percentile ranks and fitness categories as given in Tables 3- 6.

Table 3: Fitness Category Based on Stretching of Sit and Reach Test

Age Category - Men

Percentile Rank	< 18		19 – 35		36 – 49		> 50	
	inches	cm	inches	cm	inches	cm	inches	cm
99	20.8	52.8	20.1	51.1	18.9	48.0	16.2	41.1
95	19.6	49.8	18.9	48.0	18.2	45.2	15.8	40.1
90	18.2	46.2	17.2	43.7	16.1	40.9	15.0	38.1
80	17.8	45.2	17.0	43.2	14.5	37.1	13.3	33.8
70	16.0	40.6	15.8	40.1	13.9	35.3	12.3	31.2
60	15.2	38.6	15.0	38.1	13.4	34.0	11.5	29.2
50	14.5	36.8	14.4	36.6	12.6	32.0	10.2	25.9
40	14.0	35.6	13.5	34.3	11.6	29.5	9.7	24.6
30	13.4	34.0	13.0	33.0	10.8	27.4	9.3	23.6
20	11.8	30.0	11.6	29.5	9.9	25.1	8.8	22.4
10	9.5	24.1	9.2	23.4	8.3	21.1	7.8	19.8
05	8.4	21.3	7.9	20.1	7.0	17.8	7.2	18.3
01	7.2	18.3	7.0	17.8	5.1	13.0	4.0	10.3

Age Category - Women

Percentile Rank	< 18		19 – 35		36 – 49		> 50	
	inches	cm	inches	cm	inches	cm	inches	cm
99	22.6	57.4	21.0	53.3	19.8	50.3	17.2	43.7
95	19.5	49.5	19.3	49.0	19.2	48.8	15.7	39.9
90	18.7	47.5	17.9	45.5	17.4	44.2	15.0	38.1
80	17.8	45.2	16.7	42.4	16.2	41.1	14.2	36.1
70	16.5	41.9	16.2	41.1	15.2	38.6	13.6	34.5
60	16.0	40.6	15.8	40.1	14.5	36.8	12.3	31.2

50	15.2	38.6	14.8	37.6	13.5	34.3	11.1	28.2
40	14.5	36.8	14.5	36.8	12.8	32.5	10.1	25.7
30	13.7	34.8	13.7	34.8	12.2	31.0	9.2	23.4
20	12.6	32.0	12.6	32.0	11.0	27.9	8.3	21.1
10	11.4	29.0	10.1	25.7	9.7	24.6	7.5	19.0
05	9.4	23.9	8.1	20.6	8.5	21.6	3.7	9.4
01	6.5	16.5	2.6	6.6	2.0	5.1	1.5	3.8

For the shoulder rotation test, prior to the test the subject must warm up properly and the biacromial width is measured to the nearest ¼" between the lateral edges of the acromial processes of the shoulders. Then a device is placed on the back and a reverse grip is used to hold the device. The index finger of the right hand is placed at the zero point on the scale or tape used and firmly held in place throughout the test. By standing straight up and extending both arms to full length with elbows locked, the measuring device is slowly brought over head until reaching forehead level. Precautions must be taken to ensure that the right hand grip maintains zero on the measuring tape. The last successful trial is measured by taking a reading on the inner edge of the left hand on the side of the fifth digit. The final score is determined by subtracting the biacromial width from the last score obtained, which is the shortest length between both hands on the rotation test. Table 4 shows the percentile ranks and flexibility fitness categories for subjects as determined by this study.

Table 4: Fitness Category Based on Shoulder Rotation Exercise.

Percentile Rank	< 18		19 – 35		36 – 49		> 50	
	inches	cm	inches	cm	inches	cm	inches	cm
99	2.2	5.6	-1.0	-2.5	18.1	46.0	21.5	54.8
95	15.2	38.6	10.4	28.4	20.4	51.8	27.0	58.8
90	18.5	47.0	15.5	39.4	20.8	52.8	27.9	70.9
80	20.7	52.6	18.4	48.7	23.3	59.2	28.5	72.4
70	23.0	58.4	20.5	52.1	24.7	62.7	29.4	74.7
60	24.2	61.5	22.9	58.2	26.6	67.6	29.9	75.9
50	25.4	64.5	24.4	62.0	28.0	71.1	30.5	77.5
40	26.3	66.8	25.7	65.3	30.0	76.2	31.0	78.7
30	28.2	71.6	27.3	69.3	31.9	81.0	31.7	80.5
20	30.0	76.2	30.1	76.5	33.3	84.6	33.1	84.1
10	33.5	85.1	31.8	80.8	36.1	91.7	37.2	94.5
05	34.7	88.1	33.5	85.1	37.8	96.0	38.7	98.3
01	40.8	103.6	42.6	108.2	43.0	109.2	44.1	112.0

Age Category - Women

Percentile Rank	< 18		19 – 35		36 – 49		> 50	
	inches	cm	inches	cm	inches	cm	inches	cm
99	2.6	6.6	-2.4	-6.1	11.5	29.2	13.1	33.3
95	8.0	20.3	6.2	15.7	15.4	39.1	16.5	41.9
90	10.7	27.2	9.7	24.6	16.8	42.7	20.9	53.1
80	14.5	36.8	14.5	36.8	19.2	48.8	22.5	57.1
70	16.1	40.9	17.2	43.7	21.5	54.6	24.3	61.7
60	19.2	48.8	18.7	47.5	23.1	58.7	25.1	63.8
50	21.0	53.3	20.0	50.8	23.5	59.7	26.2	66.5
40	22.2	56.4	21.4	54.4	24.4	62.0	28.1	71.4
30	23.2	58.9	24.0	61.0	25.9	65.8	29.9	75.9
20	25.0	63.5	25.9	65.8	29.8	75.7	31.5	80.0
10	27.2	69.1	29.1	73.9	31.1	79.0	33.1	84.1
05	28.0	71.1	31.3	79.5	33.4	84.8	34.1	86.6
01	32.5	82.5	37.1	94.2	34.9	88.6	35.4	89.9

The muscular endurance test consists of four exercises: bench jumps, modified dips or push up, bent leg curl ups, and abdominal crunches. The bench jump exercise consists of jumping up-to and down-from either a bench or gymnasium bleacher (16 ¼" high) as many times as possible in one minute. A repetition is accounted each time both feet return to the floor. Modified dips are usually recommended for men and modified pushups to women. Modified pushups are done by lying on the floor, bending the knees and placing both hands on the floor by the shoulders with the fingers extending forward. The body is lowered to the floor until the chest touches the floor, and then returns to the starting position. The subject is to perform as many continuous repetitions as possible.

Bent leg curl-ups are done by lying on the floor facing up while bending both legs at the knees to approximately 100°. The feet should remain in contact with floor throughout the test. Arms are crossed in front of chest while raising the head off the floor until the chin is placed against the chest. This is both the start and finish positions for each curl-up. Precautions must be taken to ensure that the back of the head does not contact the floor; the hands cannot be removed from the chest. When curling up, the upper body must come to an upright position before going back down. For this exercise, subjects are allowed a brief practice period of five to ten seconds in order to become familiar with the cadence (up-down). The number of continuous reputations are performed to a two step cadence and recorded.

Lastly the abdominal crunch test is recommended only individuals who are unable to perform the bent leg curl up test because of a susceptibility to low back injury. This test is done by taping a 3 ½" x 30" strip of cardboard to the floor which is held in place throughout the test. Arms are straightened and placed on the floor alongside the trunk with palms down and fingers fully extended. Fingertips of both hands should barely touch the closest edge of the cardboard. The head is lifted from the floor until the chin is one to two inches from the chest at which moment it is kept in this position for the entire test while fingers slide forward to reach the far edge of the board then return to the near side. As many continuous repetitions as possible are performed to a two step cadence (up-down) and recorded. Subjects are permitted a practice period of five to ten seconds. Percentile ranks for each exercise are recorded in order to determine muscular endurance fitness category accordingly. Taken together, the fitness standards can be determined as indicated in Table 5.

Table 5: Percentile Rank for Muscular Endurance Test

	Men				Women			
Percentile rank	Bench Jumps	Modified Dips	Bent-Leg Curl-Ups	Abdominal Crunches	Bench Jumps	Modified Dips	Bent-Leg Curl-Ups	Abdominal Crunches
99	66	54	100	100	58	95	100	100
95	63	50	81	100	54	70	100	100
90	62	38	65	100	52	50	97	69
80	58	32	51	66	48	41	77	49
70	57	30	44	45	44	38	57	37
60	56	27	31	38	42	33	45	34
50	54	26	28	33	39	30	37	31
40	51	23	25	29	38	28	28	27
30	48	20	22	26	36	25	22	24
20	47	17	17	22	32	21	17	21
10	40	11	10	18	28	18	9	15
5	34	7	3	16	26	15	4	0

Finally, the percentiles obtained from these three tests for muscular flexibility were averaged to obtain a mean score for percentile ranking, later used to determine the flexibility fitness category for all subjects (Table 6).

Table 6: Flexibility Fitness Category Based on Average Percentile Rank

Average score	**Fitness category**
≥ 90	Excellent
70-80	Good
50-60	Average
30-40	Fair
< 20	Poor

Lastly, a biochemical assay was used to assess blood lipid profiles for all subjects. The Cardiocheck PA is a designated portable lipid analyzer as per the Clinical Laboratory Improvement Amendments (CLIA) test waiver [18]. The system calculates LDL cholesterol levels by using the Friedewald equation for total cholesterol, HDL cholesterol and triglyceride levels. Results are available within three minutes of the finger

stick. Prior to collecting capillary puncture samples, the participant's finger was cleansed with alcohol swabs and allowed to dry. Using lancets, samples were collected and immediately applied to the Cardiocheck PA chem-strip.

III. Results and Discussion

A total 104 respondents were assessed comprising fifty-two users and fifty non-users of ergogenic aids (76% males and 24% females). Among the respondents, 45.2% were married; 5.8% were widowed, separated or divorced; and 49.0% were single and which category comprised the highest number of regular gym attendees. 45.2% of respondents had lower education level; 26.9% attained educations up to STPM, Matriculation or Diploma (intermediate level); 12.5% had undergraduate degrees and 15.4% had Master/Ph.D. degrees (Table 7). Lower educational level were the majority in contrast to a previous study by Goston (2010) where most respondents were reported as degree holders. It appears that the level of education plays an important role in the fitness world as it reflects understanding and awareness of the importance of both exercise and ergonomic supplementation.

Table 7: Demographic Characteristics of the Respondents

Characteristic	(n = 104)	
	N	%
Gender		
Male	79	76.0
Female	25	24.0
Marital status		
Single	51	49.0
Married	47	45.2
Education		
Lower (PMR or lower)	47	45.2
Intermediate (Diploma or equivalent)	28	26.9
Higher (Degree and above)	29	27.9
Living Setting		
Private Residence	75	72.1
Partially supported	4	3.8
Fully supported	8	7.7
Temporary shelter	16	15.4
Others	1	1.0
Household Member		
Alone	17	16.3
Spouse/partner	43	41.3
Children	15	14.4
Siblings	12	11.5
Other relative	13	12.5
Non-family members	4	3.8
Employment Status		
Full time	89	85.9
Part time	7	6.7
Retired	7	6.7
Household Income		
Less than RM 799	10	9.6
RM 800 – RM 1999	24	23.1
RM 2000- RM 3999	40	38.5
RM 4000- RM 5999	17	16.3
RM 6000- RM 7999	4	3.8
RM 8000- RM 9999	9	8.7
Perceived health status		
Excellent	27	26.0
Good	55	52.9

Average	22	21.2

Employment status showed 89 respondents attending fitness centres worked full time while seven worked part time and another seven were retired. A total of forty respondents (38.5%) had income levels of RM 2000 to RM 3999; followed by the second largest group of twenty-four respondents with income levels of RM 800 to RM 2000; while the smallest group ranged from RM 6000 to RM 7999 (3.8%). However, income levels of RM 8000 to RM 9999 represented a higher number of respondents, most likely due to differing jobs and positions held. According to Doraisamy (2002), among young workers in Malaysia, the lowest 40% of households earn an average monthly income of RM 840, while the medium 40% of the population earn less than RM 2202. This indicates that most Malaysians are able to attend fitness centres.

From data collected, there were more than half of respondents (69.2%) had ever heard of ergogenic aids and another 30.8% were unfamiliar with this term.

Table 8 shows the lipid profile of respondents (users and non-users of ergogenic aids) in the present study. Comparison between users and non-users of ergogenic aids was accomplished by using the Independent T test, which found a significant difference in terms of total cholesterol levels ($t = -2.324$, $p = 0.022$) with a mean for users of 4.26(0.86), and a mean for non-users of 4.69(0.86). This indicates that the blood lipid profile differences between users and non-users may be attributable to the use of ergogenic aids as well as others factors such as exercise intensity, eating patterns or other unknown factors. However, comparison of fitness levels showed no significant difference between users and non users ($t = 1.246$, $p = 0.216$) with a mean for users of 1.62(0.74), and a mean for non-users of 1.44(0.61). Thus, fitness levels for both groups were similar suggesting that ergonomic aids do not, in fact, enhance individual fitness levels. Fitness levels are influenced by strength which is affected by neural stimulation that causes muscle fibers to contract maximally according to the type of muscle fiber: whether slow-twitch with greater capacity for aerobic work, or fast-twitch with greater capacity for anaerobic work. Thus, each category and individual produces greater overall force per overload and specificity of training, which implies and endorses the validity the test (specific adaptation to imposed demand) [1].

Table 8: Comparison between Blood Lipid Profile among Users and Non Users

Variables	Mean (SD)		Mean Diff. (95% CI)	t-statistic (df)	*P*-value
	Users	**Non Users**			
Total cholesterol	4.26 (0.86)	4.69 (0.86)	-0.43 (-0.77, -0.10)	-2.55 (102.0)	0.012*
HDL-c	1.09(0.41)	1.20(0.43)	-0.11 (-0.28,0.05)	-1.37(102)	0.174^{NS}
TG	1.60(0.75)	1.75(0.88)	-0.15 (-0.46,0.17)	-0.93(102)	0.355^{NS}
LDL-c	2.31(0.95)	2.62(0.91)	-0.31 (-0.68,0.05)	-1.70(100)	0.093^{NS}
TC/HDL-c	4.19(1.98)	4.24(1.49)	-0.05 (-0.74,0.63)	-0.15(102)	0.881^{NS}

*Significant at $p<0.05$ by Independent t-test.
NS, not significant at $p>0.05$ by Independent t-test

The strength of relationship between ergogenic aids and fitness levels actually demonstrated no significant relationship ($r = -0.122$, $p = 0.22$), in contrast to relationship between ergogenic aids and blood lipid status which showed a slightly positive relationship ($r = 0.224$, $p= 0.02$), as analyzed by the Pearson correlation. Hence, it appears that ergogenic aids do not enhance an individual's fitness level but do have a minor effect on blood lipids which can also be achieved without such aids.

IV. Conclusion

This study provides data on awareness and practices concerning ergogenic aids, including physical fitness levels and blood lipid profiles among those who regularly attend fitness centres in Malaysia. These results indicate that while ergogenic aids have a minor influence on blood lipid status, they most likely do not enhance an individual's fitness level. Both blood lipid status and fitness levels show a weak relationship to ergogenic aids. Hence, these aids are most likely neither essential nor required in order to achieve targeted fitness levels or blood lipid levels among those who regularly exercise to improve and maintain health, which can be achieved without such aids by enjoying a healthy diet.

References

[1]. Sizer F., Whitney E., *Nutrition, Concepts and Controversies*, Eleventh Edition (Thomson Wadsworth, 2006).
[2]. IHRSA, the 'International Health, Racquet & Sportsclub Association' 2012. Top Health Club Trends - Health Clubs Respond to Strong Consumer Demand. Available from: http://www.ihrsa.org/media-center/2012/1/11/top-health-club-trends-for-2012.html.
[3]. Harrison R.A., Holt P., Pattison D.J., Elton P.J., Are Those in Need Taking Dietary Supplements? *Journal Nutritional,* 2004, 91: 617-23.
[4]. Silver M.D., Use Of Ergogenic Aids By Athletes, Journal *of the American Academy of Orthopaedic Surgeons* Vol. 9, 2001, No 1.
[5]. Anon: Anabolic- Androgenic Steroids: Incidence of Use and Health Implications. *President's Council on Physical Fitness and Sports, Research Digest* 2005, Series 5, No. 5.
[6]. Morrison L.J., Gizis F., Shorter B., Prevalent use of dietary supplement users: demographics, product use, and medical system interaction. *Journal of the International Society of Sports & Nutrition Exercise Metabolism*, 14(4): 2004, 481-92.
[7]. William, M., The Use of Nutritional Ergogenic Aids in Sports: Is It an Ethical Issue? *International Journal of Sports Nutrition*, 4: , 1994, 120-131.
[8]. Johnson W.A, Landry G.L., Nutritional Supplements: Fact vs. Fiction. *Adolesc Med* 9, 1998, 501-513.
[9]. Sizer F., Whitney E., *Nutrition, Concepts and Controversies*, Eleventh Edition (Thomson Wadsworth, 2008).
[10]. Stoedefalke K., Effects of Exercise Training on Blood Lipids and Lipoproteins in Children and Adolescents; A review article, *Journal of Sports Science and Medicine*, 6, 2007, 313-318.
[11]. Harland J.I., Haffner T.A., Systematic Review, Meta Analysis and Regression of Randomized Controlled Trials Reporting nn Association Between an Intake of Circa 25g Soya Protein Per Day and Blood Cholesterol. *Atherosclerosis*. 200 (1), 2008, 13-27.
[12]. Reynolds K, Chin A, Lees K.A, Nguyen A, Bujnowski D, He J. A meta-analysis of the effect of soy protein supplementation on serum lipids. *Am J Cardiol*. 98(5) 2006, 633-40.
[13]. Weggemans R.M, Trautwein E.A. Relation between soy-associated isoflavones and LDL and HDL cholesterol concentrations in humans: a meta-analysis. *European Journal of Clinical Nutrition*. 57, 2003, 940-994.
[14]. Zhan, Siyan and Suzzanne, C.H. Meta-analysis of the effects of soy protein containing isoflavones on the lipid profile *Am J Clin Nutr 81,* 2005, 397-408.
[15]. Poh B.K., Safiah M.Y., Tahir A., Siti Haslinda M.D., Farina Z., Siti Norazlin N & Mohd Hasyami S., Physical Activity Pattern and Energy Expenditure of Malaysian Adults: Finding from the Malaysian Adult Nutrition Survey (MANS). *Mal J Nutr* 16(1), 2010, 13-37.
[16]. Hoeger W., Hoeger S., *Principles and Labs for Physical Fitness,* Fifth Edition, (Thomson Wadsworth, 2006).
[17]. Heyward,V.H.,and D.Wagner. *Applied body composition assessment*, (Champaign,IL: HumanKinetics, 2004).
[18]. Food and Drug Administration 2009. Cholesterol Point of Care Testing.pdf U.S.Test waived by FDA from January 2000 to present. Available from: http://www.accessdata.fda.gov/scripts/cdrh/cfdocs/].