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Dr. Nguyen Thi Gam
Teacher, Ho Chi Minh City
University of Education,
Department of Physical
Education, Ho Chi Minh City,
Vietnam

Dr. Pham Thi Le Hang
Teacher, Ho Chi Minh City
University of Education,
Department of Physical
Education, Ho Chi Minh City,
Vietnam

MM Nguyen Thuy Song Ha
Teacher, Pham Ngoc Thach
University of Medicine,
Department of Sport Medicine,
Ho Chi Minh City, Vietnam

The dermatoglyphic characteristics of ho chi minh city female aerobic gymnastics athletes

Dr. Nguyen Thi Gam, Dr. Pham Thi Le Hang and MM Nguyen Thuy Song Ha

Abstract
Based on the science of dermatoglyphics and practical applications of fingerprints in selection of athletes of nations in the world, 08 indicators were employed and fingerprints of 10 female elite athletes of Aerobic Gymnastics in Ho Chi Minh City were tested. Research results identified 09 fingerprint characteristics of female athletes of Aerobic Gymnastics.

Keywords: Dermatoglyphics, fingerprint, selection of athletes, female athletes of aerobic gymnastics

Introduction

Dermatoglyphics, underlying genetics, is the study of human beings' fingerprints. Through statistics and characteristics of these skin markings, this science explores each person's potential competences when he is still a baby to give him the right orientation for his future [1].
So far, fingerprints have been used as reference criteria for in selection of athletes and defining their physical fitness and sharpness level. Moreover, characteristics of them are also helpful for diagnosing human innate diseases. Therefore, fingerprints are meaningful in medicine, sports and especially in selection of athletes [2].
Currently, there are two aspects of dermotoglyphic application in selection of athletes. First, synthesizing fingerprint rules and features of elite athletes for establishing appropriate selection modals, assessing and forecasting their exercise ability, and implementing dermotoglyphic selection. Second, aiding the diagnose of innate illness, check and detection of diseases that affect negatively athletes' exercise ability [4]. The focus in this study was to exam dermatoglyphic of female elite athletes of arAerobic Gymnastics in Ho Chi Minh City (HCMC) to explore their characteristics.

Methodology

Methods employed in this study including documentary research, dermatoglyphic biometrics and statistics.

Research objects: Characteristics of elite Aerobic Gymnastics athletes

Participants: 10 female elite athletes of Aerobic Gymnastics in HCMC

Results
Criteria for fingerprint biometric application for HCMC female elite athletes of Aerobic Gymnastics
For fingerprint biometric of HCMC female elite athletes of Aerobic Gymnastics, 08 criteria and standards synthesized by Shao Zi Wan (1988) were employed (Table 1).

Correspondence
Dr. Nguyen Thi Gam
Teacher, Ho Chi Minh City
University of Education,
Department of Physical
Education, Ho Chi Minh City,
Vietnam

Table 1: Criteria for fingerprint biometric evaluation

No.	Criterion	Maximum score	Levels of score											
			Both hands	10	9	8	7	6	5	4	3	2	1	0
1	Atd angle	20	Male	≤ 33	34 35	36 37	38	39	40	41	42	43	44 45	≥ 46
			Female	≤35	36 37	38	39	40	41	42	43 44	45 46	47 48	≥49
2	Double Whorl (Wd)	20	20 points			15 points			10 points			0 points		
			3 and over			2			1			None		
3	Arch (A)	10	10 points			6 points			3 points			0 points		
			None			1～2			3～4			5 and over		
4	Palmar flexion creases	20	20 points		12 points		8 points		4 points		0 points			
			Not short		1 short line		2 short lines		3 short lines		4 short lines			
5	Thenar (Th)	10	5 points		4 points		3 points		2 points		1 points		0 points	
			No mutation		1 unclear shape		2 unclear shape		1 clear shape		1 unclear shape, 1 clear shape		2 clear shapes	
6	Palmar flexion creases connected	10	10 points				5 points				0 points			
			None				1 hand				2 hands			
7	Hypothenar (Hy)	5	5 points		4 points		3 points		2 points		1 points		0 points	
			No mutation		1 unclear shape		2 unclear shapes		1 clear shape		1 unclear shape, 1 clear shape		2 clear shapes	
8	Triradius	5	5 points		4 points		3 points		2 points		1 points		0 points	
			None missing		Missing 1c		Missing 2c		Missing 1 (exclude c)		Missing 1c and 1 (exclude c)		Missing 2 (exclude c)	
	Total score	100												

Shao Zi Wan (1988) (Translated by Nguyen Thi Gam) Acceptable (60 points), Fairly good (61~79 points), Good (80~89 points), Perfect (≥ 90 points)

For the convenience in data synthesis and analysis, abbreviations of main fingerprint configuration terms in dermatoglyphics are used (see Table 2).

Table 2: Abbreviations of main fingerprint configurations

No.	Abbreviation	Meaning in English
1	A	Arch
2	L	Loop
3	W	Whorl
4	Wc	Circular Whorl
5	Wp	Pochet Whorl
6	Ws	Spiral Whorl
7	Wd	Double Whorl

Fingerprint biometric results of HCMC female elite athletes of Aerobic Gymnastics

Fingerprint criteria

WHORL (vân xoáy) **LOOP** (vân móc) **ARCH** (vân sóng)

Fig 1: Finger print basic types

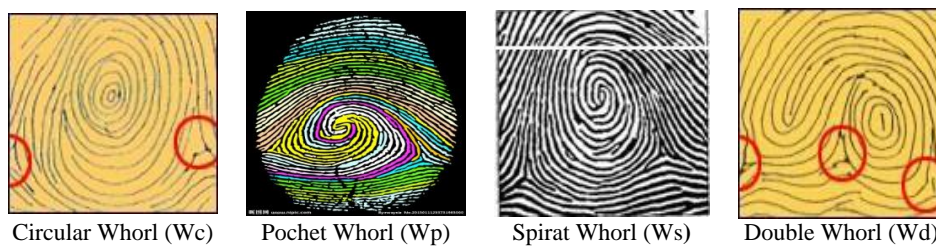Circular Whorl (Wc) Pochet Whorl (Wp) Spirat Whorl (Ws) Double Whorl (Wd)

Fig 2: Whorl basic types

Fingerprint biometric results of HCMC female elite athletes of Aerobic Gymnastics are presented in Table 3.

Table 3: Fingerprint biometric results of HCMC female elite athletes of Aerobic Gymnastics

| No. | Family name – Middle name | Given name | Arch (A) | Loop (L) | Whorl (W) | | | | Total score |
					Pochet (Wp)	Circular (Wc)	Spiral (Ws)	Double (Wd)	
1	Thai Thinh Hong	Phu	0	0	1	1	2	6	30
2	Phan Thao	Yen	0	4	0	0	2	4	30
3	Nguyen Ngoc Anh	Vy	0	6	2	0	0	2	25
4	Lê Thi Bich	Thy	0	4	4	0	0	2	25
5	Pham Nhat Phương	Trinh	0	3	5	0	0	2	25
6	Chau Kim	Anh	0	2	0	5	1	2	25
7	Tran Ngoc Thuy	Vi	0	7	0	1	1	1	20
8	Tran Ngoc Phuong	Anh	0	10	0	0	0	0	10
9	Đinh Hong	Ngoc	0	10	0	0	0	0	10
10	Ton Nu Thanh	Thanh	0	7	3	0	0	0	10
	Total		0	53	15	7	6	19	210
	Percentage (%)		0	53.0	15.0	7.0	6.0	19.0	21.0
	Percentage (%) of 03 main fingerprint configurations		0.0	53.0	47.0				

Table 3 shows the fingerprint characteristics of HCMC female elite athletes of Aerobic Gymnastics as follows: No arch (0%), 53/100 loops (53%), 15/100 pocket whorls (15%), 7/100 circular whorls (7%), 6/100 spiral whorls (6%), 19/100 double whorls (19%).

Dermatoglyphic studies have interpreted the following points:

- The arch percentage can reflect athletes' endurance component. The higher this indicator is, the worse an athlete's endurance is. In normal cases, the arch percentage is 2.24%. In certain innate diseases, this is very high, possibly up to 60~70% or even 100% (Wang Yu Kang, 1986). Athletes' arch percentages in various sports are 1.3% for male and 2% for female in elite athletics, 0.5% for male and 2.8% for female in Gymnastics, 3,0% for male and 2.5% for female in athletics; and 2.2% for male and 0.8% for female in volleyball (Thiệu Tử Uyển, 1989). The endurance is a component that well correlates with human circulatory, respiratory, nervous and muscular systems [5]. HCMC female elite athletes of Aerobic Gymnastics had no arch (0%) which shows that they had high endurance and good mentioned systems.

- The low percentage of circular whorls usually shows a person's good relative strength of upper limbs. This percentage of Liaoning elite tennis players were 27% for male and 30% for female (Yu Wen Qian & Tai Feng, 2012). However, the genetic degree of relative strength is 64% (Nguyen The Truyen, Nguyen Kim Minh & Tran Quoc Tuan, 2002) which means 36% of its could be improved through training. Nevertheless, athletes with innate genetic strength have enormous competitive advantages in elite sports. HCMC female elite athletes of Aerobic Gymnastics had the circular whorl percentage of 7% that was lower than the mentioned ones of Chinese tennis players. This is an evidence for their very good strength of upper limbs which well facilitate them in elite sport training especially for Aerobic Gymnastics that requires strong arms for full-weight support in techniques of push-up, hanging, etc.

- The higher the percentage of loops, especially double loop whorls, is, the better the owner's capability of exercise combination, rhythm, speed and nervous flexibility is (Yu Wen Qian & Tai Feng, 2012). The double loop whorl percentage of a normal person is 4~5% and that of an elite athlete is around 10% (Shao Zi Wan, 1989). This percentage of HCMC female elite athletes of Aerobic Gymnastics was 19% which proves their very good capability of exercise combination, rhythm, speed and nervous flexibility.

Regarding the fingerprint complexity, Bonnevie (1924, 1929 & 1931) states that it is the nerve distribution in the brain to be the source for the quantity of lines and the shapes of fingerprint. A good distribution of nerve cells and variety of neuron development leads to a complex fingerprint complexion. The complexity of fingerprints is shown in Figure 1.
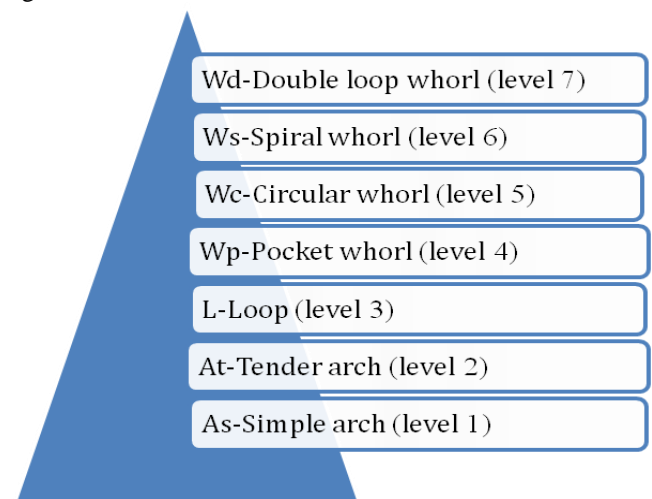

Fig 3: Fingerprint complexity

As shown in Figure 1, main fingerprint configurations of HCMC female elite athletes of Aerobic Gymnastics ranged from levels 3 to 7 and without levels 1 and 2. This proves that these athletes had highly complex fingerprint structures and very good brains (with rich neuron distribution).

Additionally, Shao Zi Wan, Dong Xiao Wei, Diao Hong Ning, Gui Fen and Liu Wen (2000) revealed a new finding in a study on double loop whorl characteristics of Chinese elite gymnastic athletes that these configurations appeared mainly in thumbs and middle fingers. 8/10 HCMC female elite athletes of Aerobic Gymnastics had double whorls on these two fingers. This status is explained as follows.

After Bonnevie (2010), nerves of fingerprints and brain areas are tightly related. There are correlations between fingerprints and areas of the brain. A person who has complex markings on thumbs owns a good ability of generalization and synthesis; the one who has complex prints on the left middle finger possesses a good imagination and space perception while that with those prints on the right middle finger is able make logical links of things and phenomena. All mentioned
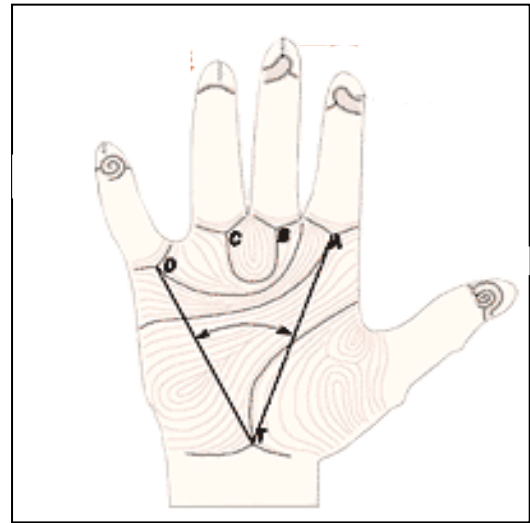
qualifications are essential for Gymnastics and Aerobic Gymnastics. This is a scientific basis for the polymerism that athletes of both Gymnastics and Aerobic Gymnastics possess double whorls on their thumbs and middle fingers.

According to Figure 1, the double whorls are the most complicated. As a result, it can be concluded that owners of these configurations are genetically characterized with good nervous distribution and development, speed, neuron flexibility and exercise combination. Aerobic Gymnastics needs complex techniques and skills which require performers to combine well their exercise ability. Moreover, it is a must that athletes of this sport take command of the high speed and continuous transformation of formats, rhythm, directions, force use and relax, etc. Hence, their nervous systems needs to be highly flexible. 8/10 HCMC female elite athletes of Aerobic Gymnastics had double whorls which show their possession of mentioned innate genetic advantages. Especially, an athlete among them had three whorls of that kind, 2 athletes had four and another one had six.

- In addition, according to Table 3, the percentages of 3 main fingerprint configurations of HCMC female elite athletes of Aerobic Gymnastics included 53% for loops, 47% for whorls and 0% for arches. It can be expressed with L>W>A. This is a big difference in comparison with Chinese female elite athletes of other sports whose expression is W>L>A. However, there is a similarity between HCMC female elite athletes of Aerobic Gymnastics and the elite athletes of Gymnastics,

Atd angle

The atd angle biometric of HCMC female elite athletes of Aerobic Gymnastics are described in Table 4.

Table 4: Atd angle biometric of HCMC female elite athletes of Aerobic Gymnastics

| No. | Family name- Middle name | Given name | Atd angle (degree) | | | | Total score |
			Left hand	Score	Right hand	Score	
1	Thai Thinh Hong	Phu	33	10	35	10	20
2	Phan Thao	Yen	40	6	38	8	14
3	Nguyen Ngoc Anh	Vy	38	8	37	9	17
4	Le Thi Bich	Thy	35	10	35	10	20
5	Pham Nhat Phuong	Trinh	35	10	35	10	20
6	Chau Kim	Anh	36	9	39	7	16
7	Tran Ngoc Thuy	Vi	39	7	38	8	15
8	Tran Ngoc Phuong	Anh	34	10	34	10	20
9	Đinh Hong	Ngoc	40	6	40	6	12
10	Ton Nu Thanh	Thanh	40	6	39	7	13
Average			37		37		16.7
			37°				

It has been researched and proved in dermatoglyphics that there is a great correlation between atd angles and human intelligence. People whose atd angles are small have great intelligence and vice versa. Hence, atd angles are called "Angle of intelligence" or "Mind competency" or spirit and intellect (Yu Wen Qian & Tai Feng, 2012). Atd angles of normal people range from 41^0 to 42^0; that of children with down syndromes range from 59^0 to 70^0; that of elite male range from 37^0 to 39^0 and that of female ones range from 39^0 to 40^0 (Shao Zi Wan, 1989). It was confirmed by Shao Zi Wan (1989) that atd angles of athletes are clearly smaller than those of high school and secondary pupils. Athletes who have good intellect can acquire techniques well thus they will gain good training and competitive spirit [6].

In competitions, besides physical fitness and technique components, athletes' psychology plays an important role. Competitors with good spirit and intellect will have good competitive psychology and can bear high pressure and own the improvisation. Hence, in selection of athletes, the atd angle is an essential criterion. Athletes with smaller atd angles have higher possibility to become elite ones (Yu Wen Qian, Tai Feng, 2012).

The mean atd angle of HCMC female elite athletes of Aerobic Gymnastics was 37^0 in both hands which was lower than that of Chinese elite athletes in other sports (39^0~40^0). In HCMC team, 01 athlete had the smallest atd angle of 33^0, 4 ones had the atd angles which were 35^0 or less (maximum score 20/20). This proves that HCMC female elite athletes of Aerobic Gymnastics have good innate intellect which is essential in sports, especially Aerobic gymnastic (A sport with difficult, various, complicated techniques and that require good acquisition). Therefore, this brings athletes a great advantage on the path to the victory of elite sports.
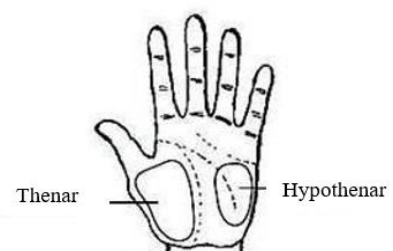
Thenar and hypothenar areas

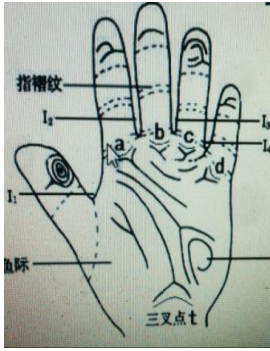

Fig 5: Thenar and Hypothenar area

Fig 6: Triradius (a, b, c, d)

After Zhang Chun Fu and Li Zhi Rong (2003), if figurations in the thenar area are clear shapes as variations of fingerprints, there is a correlation with certain genetic circulatory and respiratory diseases. As a result, the percentage of clear shapes as fingerprint variation in the thenar is an important criterion for evaluating an athlete's heart and lung functions. According to a study by Li Sui Gao (1980), the percentage of clear shape figurations is 10% for a normal person. Shao Zi Wan (1989) states that it is scarce to find these figurations in elite athletes and the percentage is just around 2.5%. Yu Wen Qian and Tai Feng (2012) found mentioned shapes in thenar areas of Liaoning tennis players with following percentages: 6% for male athletes, 4.7% for male elite ones; 4.3% for female ones, and 3.2% for female elite ones.

It has been proved in medical studies that the proportion of variation in the hypothenar areas is higher in cases of innate genetic diseases, especially those relating to the cardiovascular system. Xu Guang, in a study at East China Normal University, proves that the fingerprint variation in the hypothenar areas of excellent basketball players of the university was significantly different with that of normal people.

There was no fingerprint variation found in both thenar and hypothenar areas of HCMC female elite athletes of Aerobic Gymnastics (Maximum score 15/15). This shows that they have good heart and lung functions which is a great advantage for them in improving their performance.

Palmar flexion creases and Triradius
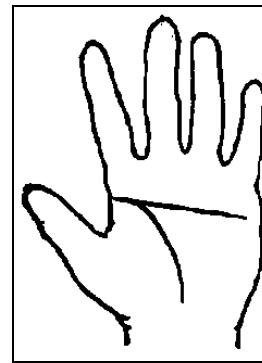

Fig 7: Nomal phalmr flexion creases

Fig 8: Palmar flexion creases connected

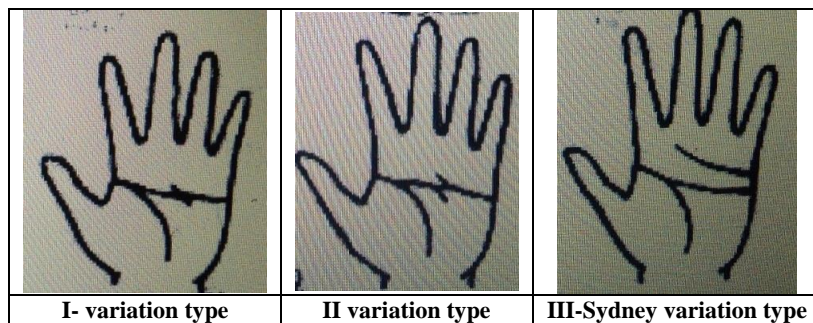| I- variation type | II variation type | III-Sydney variation type |

Fig 9: Phalmr flexion creases variation types

Biometric results show that HCMC female elite athletes of Aerobic Gymnastics have normal palmar flexion creases (not short) in both hands with maximum score 20/20.

Lai Rong Xing discovers that people with palmar flexion creases of II and III variation types have good flexibility component. HCMC female elite athletes of Aerobic Gymnastics had no Palmar flexion creases connected for which they got maximum score 10/10. Especially, the majority of their palmar flexion creases belonged to the II and

III variation types as a results they could be concluded to have good flexibility, an important component in Aerobic Gymnastics,

HCMC female elite athletes of Aerobic Gymnastics also got maximum score 5/5 for their hand triradius biometric.

After the test, fingerprint criteria of HCMC female elite athletes of Aerobic Gymnastics were synthesized and presented in Table 5.

Table 5: Fingerprint assessment of HCMC female elite athletes of Aerobic Gymnastics

No.	Criterion	Max score	Scores of each athlete									
			1	2	3	4	5	6	7	8	9	10
1	Atd angle	20	20	14	17	20	20	16	15	10	12	13
2	Loop	20	20	20	15	15	15	15	10	0	0	0
3	Arch	10	10	10	10	10	10	10	10	10	10	10
4	Palmar flexion creases	20	20	20	20	20	20	20	20	20	20	20
5	Thenar	10	10	10	10	10	10	10	10	10	10	10
6	Palmar flexion creases connected	10	10	10	10	10	10	10	10	10	10	10
7	Hypothenar	5	5	5	5	5	5	5	5	5	5	5
8	Triradius	5	5	5	5	5	5	5	5	5	5	5
	Total score	100	100	94	92	95	95	91	85	70	72	73

Table 5 shows the followings:

1. HCMC female elite athletes of Aerobic Gymnastics got maximum score with 6/8 criteria as arches, palmar flexion creases, thenar, hypothenar, Palmar flexion creases connected and triradii.
2. In the criterion of atd angles, 1 athlete got the lowest score 10/20 and 4 ones got the highest scores 20/20.
3. In the criterion of loops, 2 athletes got maximum scores 20/20, 4 ones got 15/20, 1 person got 10/20, and 3 people got 0/20. However, these three athlethes had particular fingerprint structure as described belows: 2 people had 10/10 fingers of loops and 1 person had 7/10 loops and 3 pocket whorls (all loops were of Lu configuration). As analyzed above, female elite athletes of Gymnastics and Aerobic Gymnastics all have the structure L>W>A; as a result, these 3 athletes can be considered to have fingerprint structure of elite ones.
4. According to the scale in Table 1, there were 6 perfect cases, 1 good case and 3 fairly good ones. In the team, an athlete got the maximum score 100/100. That is the most potential young athlete Thai Thinh Hong Phu who needs nourishment to exploit her innate genetic advantages.
5. In general, the fingerprint biometric results indicate that HCMC female elite athletes of Aerobic Gymnastics genetically own most of characteristics of excellent sport women which are suitable for Aerobic Gymnastics,

Conclusion

- Based on biometric and analysis results, 09 fingerprint characteristics of HCMC female elite athletes of Aerobic Gymnastics are synthesized as follows:

1. Small atd angles (the mean atd angle of both hand was 37^0). This proves the athletes' good capabilities of exercise combination, rhythm, speed and nervous flexibility.
2. Loops (7/10 athletes had loops; 2 athletes had 4 loops and 1 athlete had 6 loops). Most of the loops appear in thumbs and middle fingers which show owners' good intellect and acquisition.
3. 2 athletes had 10/10 loops; 1 athlete had 7/10 loops and 3 pocket whorls.
4. Complex fingerprint structure (from levels 3 to 7). Further, most of the athletes had double whorls (of the highest complexity) on their middle fingers and thumbs thus they are considered to have capabilities of generalization, synthesis, imagination, space perception, good logical thinking and linking things and phenomena.
5. No arch (an evidence of the good function of oxygen transportation – good Aerobic ability).
6. Not short palmar flexion creases the majority of which are of II and III variation types. This shows the athletes' good flexibility.
7. No Palmar flexion creases connected which means athletes have good health and no innate genetic diseases.
8. Normal thenar and hypothenar areas without clear shape of variation. This shows the athletes have good heart and lung functions and no innate cardiopulmonary diseases.
9. Appearance of 8/8 triradius.

- The results of this study could be used for refencences in recruiting HCMC female elite athletes of Aerobic Gymnastics. It is recommended that the sample size should be bigger.

Appendix 1: Achievements of HCMC female elite athletes of Aerobic Gymnastics

No.	Family name – Middle name	Given name	Birthday (D/M/Y)	Age	Achievement
1	Tran Ngoc Phuong	Anh	11/12/2003	14	National gold medal 2014
2	Chau Kim	Anh	13/4/2001	16	Asian gold medal 2015 (performance 3)
3	Đinh Hong	Ngoc	20/3/1999	18	1 world bronze medal 2014; 1 Asian gold medal 2017; 1 world silver medal 2017 (team performance)
4	Thai Thinh Hong	Phu	4/1/2003	14	Asian gold medal 2015; 2 Asian gold medals 2017
5	Ton Nu Thanh	Thanh	18/11/1999	18	1 world bronze medal 2014; 1 world silver medal and 1 world bronze medal 2016; 2 world gold medals 2017; 3 Asian gold medals 2017
6	Le Thi Bich	Thy	26/9/1996	21	National gold medal 2015 (performance 3); 1 Asian gold medal 2017
7	Pham Nhat Phuong	Trinh	30/7/2000	17	1 world silver medal and 1 world bronze medal 2017; 3 Asian gold medals 2017; 1 world gold medal and 1 world silver medal 2017
8	Tran Ngoc Thuy	Vi	21/81999	18	2 world gold medals and 1 world silver medal 2016; 2 Asian gold medals 2017; 1 world silver medal 2017
9	Nguyen Ngoc Anh	Vy	24/7/2001	16	World silver medal 2013 (performance 3); 1 world bronze medal 2014; 1 Asian gold medal 2017; 1 world gold medal 2017
10	Phan Thao	Yen	20/9/2005	12	National youth silver medal 2016; 1 Asian gold medal 2017

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