

Case Study on the Long-Term Recovery Process of a Woman Experiencing Amenorrhea in Long-Distance Running

Sayumi Iwamoto, Masako Ohta, and Ayako Ito

ABSTRACT

This case study presented information on a female athlete who did not match the trends observed (anthropometry and energy intake) in previous female athlete triad studies. The participant had amenorrhea and joined our research project at 19 years of age. This case study focused on the participant's personal history related to diet and practice since she started long-distance running until this study through interviews. It explored her approach to decision-making and her behavior regarding running during her high-school days. The response to oral medication treatment for menarche, which started in her first year of college, was also examined. This practical case study observed the participant in detail to obtain easily comprehensible real-life health-related data on female athletes and the significance of proper athletic conditioning education from a young age.

Keywords: athletic conditioning education, female athlete triad, long-distance runner, prevention.

Published Online: March 22, 2023

ISSN: 2796-0048

DOI: 10.24018/ejsport.2023.2.2.68

S. Iwamoto*

Graduate School of Human Life Design,
Toyo University, Japan
Sports Performance Research Institute
New Zealand, New Zealand
(e-mail: siwamoto@toyo.jp)

M. Ohta

Graduate School of Food and Nutrition
Science, Toyo University, Japan
(e-mail: masako@toyo.jp)

A. Ito

Showa University Research Institute for
Sport and Exercise Sciences, Japan
(e-mail: ayakoi@ayakoitoclinic.com)

*Corresponding Author

I. INTRODUCTION

Relative energy deficiency in sports is a serious health problem in female athletes (Statuta *et al.*, 2017), especially when it involves energy deficiency, menstrual dysfunction, and low bone mineral density comprising the female athlete triad (FAT) (Joy *et al.*, 2014, Otis *et al.*, 1997, Nattiv & Lynch., 1994). Studies on FAT have examined body characteristics and found that achieving body-mass indexes (BMI; kg/m²) of more than 18.5 kg/m² (De Souza *et al.*, 2014), requires energy availability (EA) of more than 30kcal/fat-free mass (FFM) (Loucks & Thuma 2003).

Ekiden (long-distance, multi-stage relays), a highly popular sport in Japan, requires young runners to compete and rigorously control body weight from a young age. This puts them at a high risk of energy deficiency (Logue 2020). Several studies have reported that Japanese female long-distance runners have a high percentage of menstrual dysfunction (Kajiwara & Shimeki 1993, Kikuchi *et al.*, 2008).

Our previous research project began in December 2017. Some observed cases in our study did not match the trends highlighted in the said study (>18.5 kg/m² BMI and >30kcal/FFM) (De Souza *et al.*, 2014, (Loucks & Thuma 2003), and causes of amenorrhea due to FAT were found to be deeply related to the runners' own behavior and judgment. Thus, knowing runners' histories to understand and create a prevention plan is crucial. Moreover, cases of delayed menarche and long-term amenorrhea cannot be solved solely by analyzing short-term data. While recovering from these problems, athletes struggle by themselves. Therefore, this case study discusses an athlete's struggle with amenorrhea and her long-term recovery process.

II. MATERIALS AND METHODS

A. Participant

A 22-year-old female long-distance runner with 10 years of experience, belonging to a college running team, and living in a team dormitory was recruited as the participant. At nineteen years old, she participated in our previous research project, and at that time, she had amenorrhea with a BMI of 18.5 kg/m² and no specific low energy intake and energy availability (EA), as compared to the normally menstruating team members. During the previous research project, the participant learned about issues of athletic health

conditioning, such as weight management, food intake, and FAT. The research team recommended the participant see Gynecologist B, who specialized in FAT. Written informed consent was obtained from the participant for the case report's publication. This study was approved by the Ethics Committee of Toyo University (Approval Number: TU2017-010-TU2017-H-005-TU2018-H-002).

B. Interview

The research team re-interviewed the participant regarding her health condition at least twice a year after the amenorrhea diagnosis. The last interview was conducted in September 2020 (fourth-year college). At the end of the previous research project, the participant still did not experience normal menstruation; therefore, in this research project, we conducted further interviews to obtain more details on the health history and other health related factors of the participant. We also checked her hormone metabolism via urine testing. The participant was questioned on her approach to running, overall practice characteristics, awareness of body characteristics, eating habits, and menarche and menstrual cycles (Table I).

TABLE I: HISTORY OF THE PARTICIPANT

Team	Age	School Year	Approach	Practice	Body Characteristics	Eating habits	Menarche (menstrual)	Gynecologist	
								A	B
Junior high school	13	2011	Had fun at first, later getting more serious	Followed the team practice	Didn't think much about weight	Ate anything freely	Didn't occur naturally		
	14	2012							
	15	2013							
High school	16	2014	Very serious and strict	High intensity and short duration (no morning sessions)	Target BMI was 17.5; ideal weight was 43 kg; strictly adhered to the target	Controlled carbohydrate intake and water consumption	Didn't occur naturally		
	17	2015							
	18	2016							
College	19	2017	Very serious and strict	Followed the team practice twice per week, self-practice on other days	Strictly adhered to high school targets of her own free will until the middle of the second year	Fewer carbs because of eating too many side dishes	Took oral medication on the coach's and doctor's recommendation	April	
	20	2018							Feb
	21	2019							Three times with a pill
	22	2020							Naturally in August

III. RESULTS

The participant started running for the school team in the first year of junior high school. Initially, she enjoyed running and did not take it seriously, and followed no dietary limitations. Thus, her body weight did not matter. As her interest in running increased, she aspired to become an Ekiden team member. Her menarche did not occur naturally during junior high school, but she was not worried and did not inform her mother or coach that she had not yet reached menarche.

The participant joined an elite high school running team to participate in Ekiden. The team monitored each member's body weight, which BMI was set at 17.5 kg/m² by the participant. The participant tried hard to control her body weight. She voluntarily wore extra clothing on long training runs, reduced food intake, restricted carbohydrate intake, and even limited hydration. Her menarche still did not occur, and as she only cared about the target BMI, she felt it was better not to menstruate and did not inform anyone.

When she entered a high-level college running team, the team provided her breakfast and dinner. The nutrient content was calculated at 2,300kcal/day, with 900kcal for breakfast, 1,000kcal for dinner, with a bowl of rice (160g=200kcal), and then~400kcal for lunch where 60% of total calories were from carbohydrates. This amount of kcal was requested by a nutritionist, and the participant consumed more food while on the team than when she was in high school. She consumed all food items recommended by the nutritionist because she believed that they contained important nutrients; however, she could not always finish her portion of rice because she became full, which meant that she did not always consume the allotted carbohydrates. The participant continued tracking her body weight.

The running team conducted interviews on health status, medical concerns, and supplements used in the

team. The participant then informed her coach about her menarche condition. The coach recommended Gynecologist A (Gynecologist A in Table I), who prescribed an oral medication, resulting in menarche at 19 years (April 2017). However, menstruation did not occur again naturally, and she subsequently stopped seeing Gynecologist A.

In December 2017, the participant joined our previous research wherein various measurements on anthropometry, consumption and energy intake, metabolism, blood samples, bone density, physical fitness, running performance, and medical status were performed. She did not have normal menstruation at that time. Based on her menstrual condition, the previous research team consulted Gynecologist B, who specialized in FAT in February 2018 (Table I). Thereafter, Gynecologist B's recommendation to increase food consumption was followed. For almost one year, Gynecologist B monitored the participant's blood hormone levels and eating patterns. The participant attempted to eat all meals provided in the dormitory. However, she regularly felt nauseous. By the end of the second year, she became accustomed to the food quantity and could eat all meals without being nauseous. Subsequently, she decided on a particular practice style (extra clothing on long runs). During the previous research project education, the participant gradually changed her eating habits. The advice given by Gynecologist B did help; however, she continued to push herself to run more, even when tired. Despite following Gynecologist B's advice, no menstruation occurred in 2018. Thereafter, she took oral medication thrice (February 2019, June 2019, and March 2020) and menstruated twice during that period. Thus, menstruation did not occur naturally.

At the end of our initial research project, the participant was dissatisfied with the project results. Therefore, we created a new research project that examines her hormone metabolism via urine (Complete hormones FMV, Genova Diagnostic, USA) by another specialist (February 2020, the end of third-year college). The specialist discovered that her glucocorticoid metabolism was low because of her stress-induced hormonal pathways (all-Tetrahydrocortisol+Tetrahydrocortisol<Tetrahydrocortison). This implied that the steroidogenic pathway could not transit androgenic (Dehydroepiandrosterone<dl=Unable to calculate results due to less than detectable levels of the analyte) and estrogen (Estradiol 1.0) metabolism. After the specialist's guidance, the participant realized that she needed to modify her lifestyle and perspective on health. She then stopped the additional self-training. Finally, menstruation occurred without medication in August 2020. In the last interview, she commented, "Since my third year in college, I felt eating was not the only reason for my menstrual dysfunction." She added, "In my fourth year, I stopped running forcibly because, somehow, my mind changed, and I stopped pushing myself."

Menarche did not occur until the age of 19, and only then occurred with the use of oral medication; the participant did not experience natural menstruation. She tried to take oral medication thrice; however, she reported that her menstrual cycle only came twice between the age of 20–21 years. This project showed the importance of checking menstruation metabolism and following the recommendation of a specialist. Finally, after doing so, the participant's menstruation occurred naturally at the age of 22, after almost four years of treatment.

IV. DISCUSSION

This case study demonstrated that substantial time is needed to recover from amenorrhea and showcased an athlete's internal struggles during that time. In the beginning, the participant had a BMI of 18.5 kg/m², which bordered on FAT (De Souza *et al.*, 2014). She had the same subcutaneous fat levels and leanness ratio score as the regular groups (Iwamoto *et al.*, 2021). Her anthropometric characteristics could be described as not too light or skinny. Moreover, her energy intake was more than average for Japanese women (at 2,300kcal) (Ministry of Health 2020), which was similar to the regular menstrual group (Iwamoto *et al.*, 2021). Therefore, the factual gap between the overall FAT risk based on prior research and the participant's real condition must be recognized.

During her high-school days, the participant's approach to the sport was far from healthy, because she had a strong desire to improve her performance. There was a gap between her behaviors and her athletic health condition, likely because her junior and high schools lacked adequate opportunities for proper conditioning. Athletic conditioning education can affect an athlete's reaction and behavior toward eating habits and training and, thus, requires adjustment.

After the participant joined our research project, her beliefs regarding improving running performance did not change immediately. However, her understanding of being healthy for performing well changed gradually (almost six months later). Upon entering the college team, the participant needed more food than she did during high school, although she could not consume all carbohydrates. Following Gynecologist B's advice, the participant tried harder and forced herself to eat more, which made her physically uncomfortable and overly full. It took nearly two years for her body, especially her stomach, to adjust to the amount of food consumed. Therefore, understanding of health, the way of thinking about it, behavior, and body reaction cannot change at the same pace.

The participant understood that she needed to consume the proper amount of food and followed what was recommended by a medical professional. However, she became nervous about controlling her body weight, and her self-practice escalated. Despite taking care of her diet as recommended, she was stressed by amenorrhea symptoms, weight gain, and poor running performance.

Athletes face struggles on their own. The participant's team's conditioning staff obtained information and advice on athletes' health conditions. Nevertheless, there was a gap between the roles of the athletes and the conditioning staff. Conditioning staff must understand the athletes' situations to give them the right advice. Furthermore, sports researchers should consider that the goal of an athlete is to be healthy while pursuing challenging sports performance.

V. CONCLUSION

Delayed menarche and long-term amenorrhea are common female athlete health problems, which cause mainly from their behavior and beliefs from high athletic performance goal during junior stage. Therefore, quick, and single solutions are impossible to attain. During senior stage the athlete tried to fix those health issues, thus, long process and time are highly needed to make their body and thinking way adjust. Athletic staff need to understand the real situation deeply. Moreover, it is necessary to give accurate health athletic condition for junior athletes.

ACKNOWLEDGMENT

We thank the athlete for participating as the case study subject, coaches, and the previous research team members, Kiyoko Sugita, Kazuko Ishikawa-Takata, Masaharu Kagawa, and Teturo Suzuki, for supporting the study.

FUNDING

This work was partially supported by Toyo University Olympic and Paralympic promotion special research project B and a research grant from Toyo University.

CONFLICT OF INTEREST

Authors declare that they do not have any conflict of interest.

REFERENCES

- Nattiv, A., & Lynch, L. (1994). The Female Athlete Triad. *The Physician and Sportsmedicine*, 22(1), 60–68. <https://doi.org/10.1080/00913847.1994.11710446>.
- De Souza, M. J. *et al.* (2014). 2014 Female Athlete Triad Coalition Consensus Statement on Treatment and Return to Play of the Female Athlete Triad: 1st International Conference held in San Francisco, California, May 2012 and 2nd International Conference held in Indianapolis, Indiana, May 2013. *British journal of sports medicine*, 48(4), 289. <https://doi.org/10.1136/bjsports-2013-093218>.
- Iwamoto, S., Sugita, K., Ishikawa-Takata, K., Kagawa, M., Ota, M., Suzuki, T., & Hume, P.A. (2021). Understanding anthropometry, metabolism, and menstrual status of Japanese college female long-distance runners. *International Journal of Kin anthropometry*, 1(1), 10–17. <https://doi.org/10.34256/ijk2113>.
- Joy, E. *et al.* (2014). 2014 female athlete triad coalition consensus statement on treatment and return to play of the female athlete triad. *Current sports medicine reports*, 13(4), 219–232. <https://doi.org/10.1249/JSR.0000000000000077>.
- Kajiwara, Y., & Shimeki, I. (1993). Menstrual disorders and injuries in long distance runners of senior high school girls. *Annual Report of the Faculty of Education Bunkyo University* 7, 143–147.
- Kikuchi, M., Nakamura, I., & Kashimura, O. (2008). The athletic factors and status of irregular cycle and amenorrhea in the female college middle and long-distance runners. *Japanese J. Sch. Health* 50, 49–55.
- Loucks, A. B., & Thuma, J. R. (2003). Luteinizing hormone pulsatility is disrupted at a threshold of energy availability in regularly menstruating women. *The Journal of clinical endocrinology and metabolism*, 88(1), 297–311. <https://doi.org/10.1210/jc.2002-020369>.
- Logue, D. M., Madigan, S. M., Melin, A., Delahunt, E., Heinen, M., Donnell, S. M., & Corish, C. A. (2020). Low energy availability in athletes 2020: an updated narrative review of prevalence, risk, within-day energy balance, knowledge, and impact on sports performance. *Nutrients*, 12(3), 835. <https://doi.org/10.3390/nu12030835>.
- Ministry of Health, Labour and Welfare. (2022, August). *Overview of the Dietary Reference Intakes for Japanese 2020*. <https://www.mhlw.go.jp/content/10900000/000862500.pdf> 2020.
- Otis, C. L., Drinkwater, B., Johnson, M., Loucks, A., & Wilmore, J. (1997). American college of sports medicine position stand. The female athlete triad. *Medicine and science in sports and exercise*, 29(5), i–ix. <https://doi.org/10.1097/00005768-199705000-00037>.
- Statuta, S. M., Asif, I. M., & Drezner, J. A. (2017). Relative energy deficiency in sport (RED-S). *British journal of sports medicine*, 51(21), 1570–1571. <https://doi.org/10.1136/bjsports-2017-097700>.

Sayumi Iwamoto

Japan, 1967. 11. 13. Studied at Mukogawa Women's University, Hyogo Japan in March 1990. Took up a master's program (physiology) at the University of Tsukuba, Ibaraki Japan from 1994 to 1997. And completed a PhD in sports science (Injury prevention) at Waseda University, Saitama Japan in 2011.

She worked as Sales Agent at Green Mate and became an Athletic Trainer for a female long-distance running team for Mita Industry Co., Ltd. And worked as Professional Athletic Trainer for baseball, tennis players, golfer and keirin racers. Moreover, Managed amateur male and female basketball, volleyball, long distance, junior rugby, and junior tennis teams for over 30 years. Since 2006, she worked at Toyo University as a Lecturer, Associate Professor (2008–2018) and Professor (2019-).

Akihiro Hirata, Tetsuya Nakajima, Sayumi Iwamoto, Yuko Oguma and Naohiko Kotake. (2022) A comparison of physical characteristics in starters and non-starters in a Japanese university rugby football player. *The Japanese Journal of Physical Fitness and Sports Medicine*, 71 (6) 523–530.

Sayumi Iwamoto, Kiyoko Sugita, Kazuko Ishikawa-Takata, Masaharu Kagawa, Masako Ota, Teturo Suzuki, Patria Anne Hume (2021) Understanding anthropometry, metabolism, and menstrual status of Japanese college female long-distance runners. *International Journal of Kinanthropometry*, 1(1) 10–17.

Sayumi Iwamoto, Tetsuya Nakajima, Chihiro Ohta, Kiyoko Sugita, Kazuko Ishikawa-Takata. (2020) Preseason physique control in elite rugby team: Case report using skinfold and Leanness ratio score. *Journal of training science for exercise and sport*, 32 (4), 265–272.

Dr. Iwamoto.

Memberships of professional societies

Japanese Society of Clinical Sports Medicine,

Japan Society of Training Science for Exercise and Sport

Japan Society for Athletic Training

Awards received.

2018 Outstanding Paper Award given by Society for Athletic Training

Masako Ohta

Born in Fukuoka, Japan on April 24, 1972. Graduated from the Department of Life Science, Faculty of Home Economics, Showa Women's University, Tokyo Japan in March 1996. In the same year, she obtained National Registered Dietitian. In 1998, she completed her graduate studies at Showa Women's University where she was a member of the doctoral program from 2001 to 2004, and in 2005, she received her Ph.D. Specializes in nutrition, especially vitamin and amino acid metabolism *in vivo*.

She worked for a food company, Natori Corporation, for 6 years, where she was involved in product development and quality control. She then worked as a research assistant at RIKEN for 1 year, followed by 3 years as a Kokusai Gakuin Saitama College teacher, before joining Toyo University in 2009. Currently, she is an associate professor at the Department of Food and Health sciences, Faculty of Food and Nutritional sciences, Toyo University.

Akiho Shinagawa, Naho Serizawa, Tomoki Yamazaki, Ayako Minematsu, Yuichi Miyakoshi, Tomohiro Yano and Masako Ota (2022) Short-term combined intake of vitamin B₂ and vitamin E decreases plasma homocysteine concentrations in female track athletes. *Dietetics*, 1, 216–226.

Ayako Minematsu, Naho Serizawa, Akiho Shinagawa, Tomoki Yamazaki, Yuichi Miyakoshi, Tomohiro Yano and Masako Ota (2022) Endurance exercise increases next day fasting plasma homocysteine concentrations in female long-distance runners. *J.Clin.Physiol*, 52,151–159.

Dr. Ota.

Memberships of professional societies

Japanese Society for Medical Use of Functional Foods,

Japan Society of Nutrition and Food Science

The Vitamin Society of Japan.

Ayako Ito

Japan, 1969. 8 .7. Studied at Showa University school of medicine, Tokyo Japan in March 1994. After she got the sports doctor license in 1998, She got a specialist in Plastic surgery and completed a PhD in medicine (Plastic Surgery) at Showa University Tokyo, Japan in March 2000.

She worked as a medical doctor especially on Critical Care Medicine (CCM) and Plastic Surgery fields in The Showa University Hospital for 12 years. She opened own clinic at Tokyo in April 2011 after studying preventive medicine including hormone treatment and nutrition.

Since October 2020, she has been a hospital lecturer in plastic surgery at Chiba University and Showa University hospital and Showa University Research Institute for Sports and Exercise Sciences.

Publish journal.

Ayako Ito (2020) 形成外科 痩身機器(2)焦点式低出力体外衝撃波 CELLACTOR SC1 ultraの効果と実際」雑誌形成外科 63(6) 701–711.

Ayako Ito (2017) Layered Therapyを用いた顔から首の形態改善治療と早期・長期経過について 日本美容外科学会会報 39(1) 29–42.

Ayako Ito (2016) 当院における体内からの抗加齢療法 -ホルモン補充療法・分子整合栄養療法・キレーション療法・食物アレルギー-. 日本美容外科学会会報. 38(3) 110–117.

Dr. Ito.

Memberships of professional societies

Japanese Society of Clinical Sports Medicine,

Japanese Society of Plastic and Reconstructive Surgery,

Japan society of Aesthetic Plastic Surgery,

Japan Society of Aesthetic Surgery,

Japan Society for Laser Surgery and Medicine,

Japan Society for Foot Care and Podiatric Medicine,

Japan Sport Association and American Society of Plastic Surgeons.