

Cardiovascular and Energy Requirements of Parents Watching Their Child Compete: A Pilot Mixed-Methods Investigation

Lochbaum M.^{1,2}, Prosoli R.³, Barić R.³

¹*Department of Kinesiology and Sport Management Texas Tech University, USA*

²*KIHU - Research Institute for Olympic Sports Jyväskylä, Finland*

³*Faculty of Kinesiology, University of Zagreb, Croatia*

Abstract

Purpose: Researchers have extensively documented the cardiovascular and metabolic demands for sports participation. To date, researchers have ignored the same requirements of competitor's parents. Hence, our purpose was to document parent cardiovascular and metabolic responses to watching their child compete while also paying particular attention to their thoughts before and after the competition. Achievement Goal Theory (AGT) drove interpretation of parent thoughts.

Material: Parents wore a device, made by Firstbeat Technologies, which continuously monitored heart rate. The parents wore the device the night before the competition to be acclimated to the technology and during the event until later in the day. Parents also completed two open-ended questions, one before the tournament and one after the contest.

Results: Before the contest, the dad expected that his son won the event (Croatian National Championships for juniors). Conversely, the mother's expectations centered more on her son's enjoyment and competing to the best of his abilities. Parents had differing cardiovascular and energy requirement responses to watching their son compete. In addition, post-competition reflections differed as the father expressed disappointment whereas the mother expressed sadness.

Conclusions: The data presented are unique and a first in the sports literature. The parents varied in the intensity of their cardiovascular responses and calories burned while watching their son compete. The father's cardiovascular response over the course of watching was that of an aerobic workout. Whether this pattern is unique or universal are a critical research question. Last, AGT appears relevant when assessing the parent's expectations.

Keywords: achievement goal theory, qualitative research, heart rate monitoring, youth sport.

Introduction

Researchers have extensively documented the physiological demands of competitive sports participation. Sports scientists have been able to increase documentation with the advent and continual upgrading of wearable technologies. For instance, these sports scientists have documented the physiological responses of athletes competing in team sports such as handball [1], and soccer [2]. Likewise, they have published on the physiological requirements in individual sports such as judo [3], table tennis [4], and hard and clay surface tennis [5]. Researchers have even examined the physiological responses of top-level European basketball referees [6]. From this body of literature, sports scientists researched and provided training programs that best prepare athletes and referees for the physiological demands of many sports.

Though indeed, the athletes and referees' physiological states are most important for bettering training with the goal of performance enhancement as well as injury prevention, there are others involved in the competitive process, namely spectators. Indeed, in youth sport, the spectators relate to the youth participants – namely parents. Researchers have reported that parents serve a vital role in athlete development [7], a source of youth enjoyment [8-10], and express a broad range of verbal reactions during sporting contests [11-12]. Given the importance of parents to the youth sports experience,

it is surprising that researchers have not examined the physiological responses and thus demands of spectating their children.

In addition to uniquely measuring parent physiology while watching their child compete, we sought to gain insight into their expectations and reactions to their child's participation in this prestigious event. For decades, researchers have examined the dichotomous and contemporary variants of Achievement Goal Theory (AGT) in competitive sport. Large-scale meta-analyses on perceived goal orientation climate [13] and the individual orientation perspectives [14-17] exist. AGT helps in describing, explaining, and predicting behavior, thoughts, and emotions in the competitive sports environment. The key to this investigation is the tie between AGT and physiological reactions as documented recently [18].

From the dichotomous perspective, the two dominant climates and individual orientations are task or mastery and ego or performance. Improvement motivates individuals endorsing or supporting a task or mastery orientation. Conversely, an ego-oriented person or climate strives to win and is motivated to attain high normative standards of ability. Meta-analytic of the dichotomous AGT framework from the climate [13] and individual [17] are consistent in that the task orientation is consistently small to moderate in meaningfulness correlated with intrinsic motivation, positive emotions, and such desired achievement context variables. The ego orientation or climate is routinely viewed less favorably in youth sports context is in reality consistently unrelated or at best

modestly related to undesirable achievement correlates (i.e., negative emotions). Hogue and colleagues [18] experimentally demonstrated that ego-involving climates caused heightened salivary cortisol response in middle school children. They interpreted salivary cortisol as indicating higher stress because of the ego environment.

When thinking of actual sports performance, only Lochbaum and Gottardy [15] have summarized the AGT literature and sports performance. Their quantitative review concerned Elliot's [19-20] approach-avoidance framework. While the dichotomous task and ego distinction relate to how competence is defined, the approach-avoidance dimension relates to how competence is valenced. An approach valence indicates a behavior initiated by a positive or desirable event or possibility such as excited to improve (mastery-approach goal) or win (performance-approach goal). In contrast, an avoidance valence indicates a behavior initiated by an adverse or undesirable event or possibility such as hoping to avoid getting worse (mastery-avoidance goal) or getting beat (performance-avoidance goal).

Results based on Lochbaum and Gottardy [15] random effects model indicated that the performance goal contrast (i.e., being more excited to win than hoping to avoid losing) had the most substantial facilitative impact on performance (effect size of .73) followed by the mastery and performance-approach goals. Both of the avoidance goals performance and mastery had small non-significant and detrimental effects on performance. Thus, it is possible that performers perceive a performance or an ego climate as stressful though also beneficial to the real outcome. Indeed, in youth sports, parents are key players in creating climate perceptions.

Purpose, materials, and methods

Our purpose was to document the physiological state of parents watching their child participate in a highly competitive environment, the Croatian National Championship while trying to gain insight into the parents' expectations and reaction to their child's experience. Based on the AGT framework, the literature base, and the competitive environment, parent expectations and responses to their son's competitive experience were *a priori* interpreted within an AGT context. We expected a higher expectation of winning to be associated with a heightened physiological response.

Two parents, a mother, and father of the same adolescent were the participants in this pilot investigation. The mother at the time of the data collection was 41 years of age and 158 cm tall, 60 kg in body weight. The father was 44 years of age and 175 cm tall, 78 kg in body weight. Both parents self-reported being moderately physically active and supportive of their son's National Team aspirations.

Parents self-reported their year of birth, height, and weight. To measure the physiological processes involved in spectating, both parents wore the Firstbeat Technologies Bodyguard 2 device (<https://www.firstbeat.com/en/wellness-services/individual-wellbeing/>). The

Bodyguard 2 records heart rate at 1 ms intervals (1000 Hz) at a sampling rate of 12.5 Hz. The Bodyguard 2 measured the participants' R-R intervals. The Firstbeat analytics allow for calculation of oxygen consumption and energy expenditure that were important for this investigation. In addition, the device is sensitive to movement data (i.e., steps). The company designed the Bodyguard 2 for long-term uninterrupted measurements with a 20-day storage capacity with only little needs for recharging. The participants as would anyone wearing the device attached it to their skin with two chest electrodes.

To gain a better understanding of the physiological responses, both parents completed two open-ended questions. The first question concerned their expectations for the day. Specifically, the question was "Please give a short description of your expectations regarding today's competition." Parents answered this question 2 hours before their son's first judo fight. The second question concerned a retrospective report on the entire competition. The exact question was "Please describe your day, give us some thoughts about today's competition, and describe how you felt during today's competition." The parents completed this second open-ended question 4 hours after their son's last fight.

The article's second author purposefully approached the two parents as potential participants. The second author knew that their son would be competing at a National Championship event. Given the son's competition history, the second author anticipated that he would have many fights and that the parents would be engaged (i.e., attending the competition). The son competed in five judo fights (won, lost, won, won, lost) from 9:38 am until 12:20 pm. The last fight was a bronze medal fight, which he lost and thus finished fifth. The second and third author obtained University of Zagreb human subject approval. Both parents consented to participate. The second author provided each parent with a Bodyguard 2 device, electrodes, and the wear instructions. Parents wore the device continuously from 20:00 pm the night before the competition until 17:00 pm the day of the tournament. The second author collected the technology, and uploaded the data directly to the Firstbeat SPORTS software. As previously mentioned, the parents completed two open-ended questionnaires. The parents wrote their answers directly into a Google form document. The second authors texted the link to both parents.

The research utilized a mixed-method approach. As described by Creswell [21], a mixed-method approach involves both qualitative and quantitative data that the researcher integrates. The notion is a more in-depth analysis of the research topic is accomplished compared to just one of the approaches [22]. In our research, parent physiological reactions were quantitative data and parent expectations and responses to the day were qualitative data. For the two open-ended questions, the second author, and a colleague individually translated the written answers into English. Though qualitative interpretive approaches exist, the research team read the responses and discussed the themes present. As mentioned in the introduction, the

research team *a priori* decided on an AGT focus.

Results of the research

Quantitative data. Figure 1 (father) and 2 (mother) are the Firstbeat Technologies printouts of the parent heart rates and energy expenditures. We placed the markers (F1, F2, etc.) and results (W, L) for each fight on the graphs. Visually, it is clear that the mother's highest reactions and energy expenditures were during the fights whereas the father's most significant reactions and energy expenditures were after each fight. The second fight was the most demanding on both parents because they had to wait to see if their son could get back into the competition based on his opponent's next fight. This result also meant that he could no longer enter the finals nor win the gold or silver medal at the National Championships. In total, he had five fights from which he won three and lost two. The

second lost match was the fight for the bronze medal so at the end he finished in the fifth place.

At no time did the parents run around or engage in any intentional physical activity. The data presented relate to speculation only. As found in Table 1 and based on age-predicted maximal heart rate, we provided the heart rate zones for differing levels of cardiovascular physical activity. The mother and father's results were different as the father's heart rate activity was sufficient to be rated as aerobic based training (i.e., minutes accumulated of at least 30 percent of predicted maximal oxygen consumption). The father amassed 50 minutes of classified moderate-to-vigorous physical activity. On the other hand, the mother's heart rate patterns were insufficient for a training effect. The mother gathered 24 minutes of classified moderate physical activity. Figure 3 (father) and Figure 4 (mother) provide a breakdown of energy sources, carbohydrates or

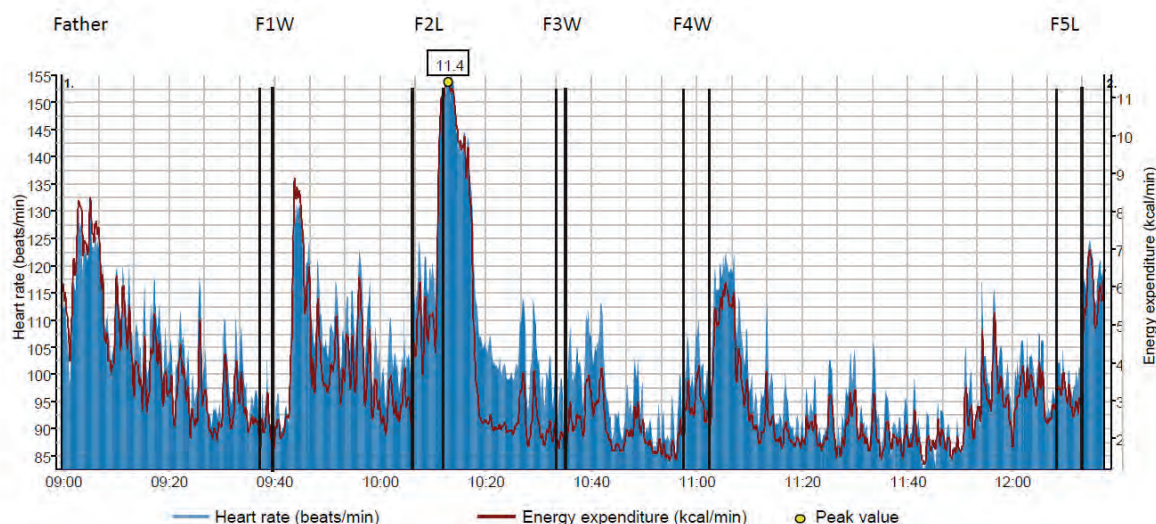


Figure 1. Cardiovascular and energy expenditure patterns of father immediately before, during, and immediately after watching son compete

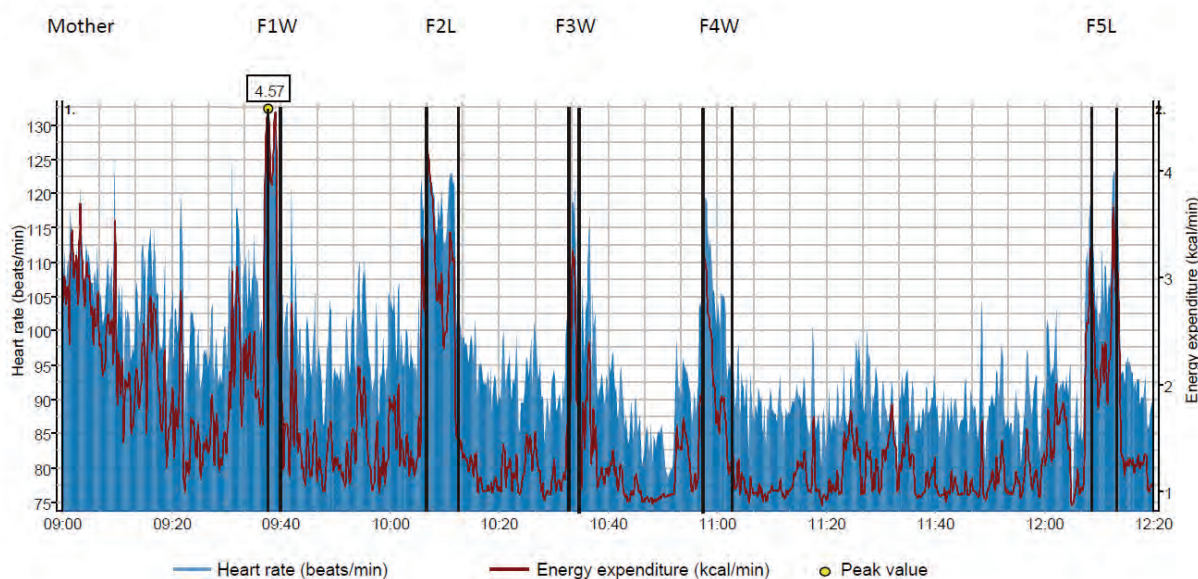


Figure 2. Cardiovascular and energy expenditure patterns of mother immediately before, during, and immediately after watching son compete

fats. Both parents utilized both energy sources nearly in equal proportions.

Qualitative data. The first open-ended question asked was “Please describe your expectations for today’s competition.” The father’s answer was short. It was “Victory“ whereas the mother wrote more.

I know that my son is capable, that he can and wants to do it. I expect that he shows that and that his confidence will be at that level so, in the end, he is satisfied with what

he achieved.

The second question asked was “Please shortly describe how your day went, describe your thoughts about today’s competition and describe you felt during it.“ The father’s response was a series of descriptive words and was as follows:

It was Saturday, it was a hard day, without rest, uptight and intense. Competition: stifling, hard chairs, stinking

Table 1. Descriptive data for time before, during, and immediately after competition for each parent

Variables	Mother	Father
Average HR (bpm)	96	103
Lowest HR recorded	75	82
Highest HR recorded	134	154
High intensity zone (min)	0	0
Anaerobic threshold (min)	0	3
Aerobic zone 2 (min)	1	6
Aerobic zone 1 (min)	23	41
Training effect (Firstbeat defined)	1.5 (facilitated recovery)	2.5 (maintained aerobic fitness)
Calories (kcal) from fat	161	343

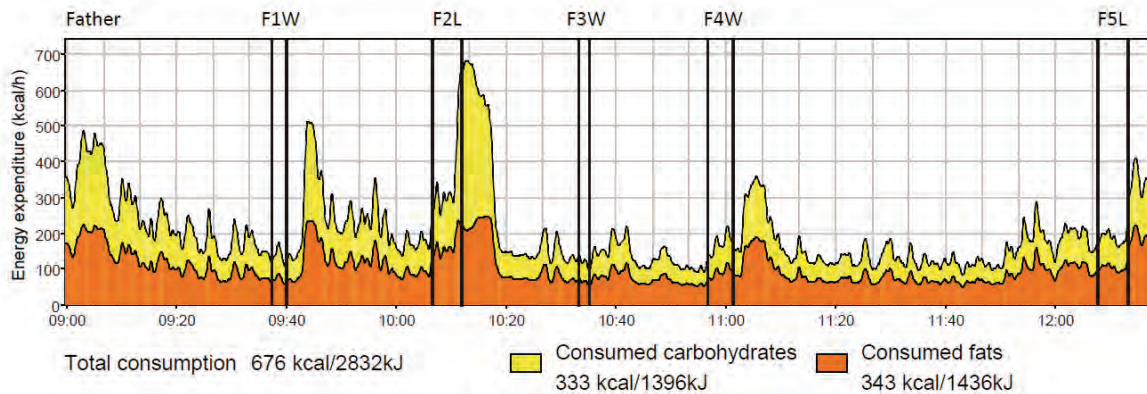


Figure 3. Caloric energy sources and totals of father immediately before, during, and immediately after watching son compete

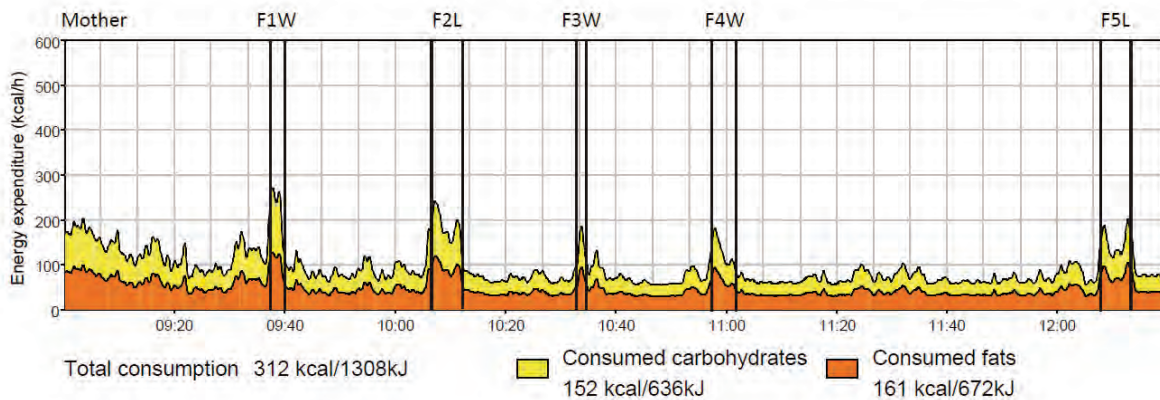


Figure 4. Caloric energy sources and totals of mother immediately before, during, and immediately after watching son compete

kimonos, waiting, disappointment, moving on.

Again as with the first open-ended question, the mother wrote a good deal more than her husband.

I enjoy spending time with my kids, and I love when I am involved in their sports activities, like today. I am very excited because I know that my son wants to win a medal and I also have the same expectations. At the end of the competition, I am sad because I think my son is sad. I try to hide my emotions because I am afraid that it will make him even sadder. When we came home, I closed myself in the bathroom pretending I was doing the laundry, cried and then calmed myself. Afterward, we all went to a restaurant where we talked a lot, got angry, made up and then decided we are ready for new battles.

From an AGT perspective, the father expressed a strong ego goal orientation with his emphasis and reflections on wanting to win and being disappointed in his son's losing. Though the mother's open-ended answer before the event seemed to convey a task goal orientation, her son doing his best, she expressed her expectation was congruent with her son, to win a medal. This expectation again was the only one the father expressed.

Discussion

This mix-methods approach with physiological data is unique to the literature. Dorsch and colleagues [11] used a mixed-methods approach with many sources of qualitative data and quantitative observational data. We sought to expand the research base by quantitatively documenting parent cardiovascular and metabolic parameters in and around their son's competition. Given physiological reactions without context are without meaning and open to a great deal of interpretation, we qualitatively investigated before and after the sporting event the mother and father's expectations and reactions to their son's competition. The cardiovascular and thus metabolic patterns differed remarkably and consistently between father and mother. The father reacted to the match outcome whereas the mother was engaged in the fight and seemingly physiologically disengaged between fights. The qualitative answers provided clues into the differing cardiovascular patterns. When combined, the quantitative and qualitative results are worthy of discussion and future lines of research.

Though biased in that two of the three authors favors AGT across our careers, AGT fit the open-ended responses [19-20]. Both the father and mother at some point expressed winning as the goal or expectation. The father indeed expressed winning as the only goal, and this perspective seemed to dictate his physiological reactions. The father's results are in line with Hogue and her colleagues' [18] experimental investigation of the impact of goal climate on middle school students' stress response. An ego-involving climate leads to greater salivary measured cortisol in the middle school-aged participants. The mother interpreted her goal to be congruent with her son. As mentioned in

the introduction, the research community far too often paints the performance- or ego-orientation as detrimental. The negative emotions expressed are consistent with meta-analytic research. Though small in meaningfulness, researchers have reported that the ego goal and ego climate correlate with the expressed negative emotions. The negative feelings seemed in direct response to losing. Asking the parents their reactions between each fight would help understand the full pattern of emotions across the competition experience.

As with any investigation, limitations exist. Given our research was a pilot in nature, the main limitation is sample size though the study itself seems unique to the youth sports literature. This restriction provides future research directions. For instance, a more substantial sample or repeated measures design with the same parents or set of parents across many competitions will aid this research topic. The event itself was a major competition and potential stepping stone for the adolescent. He needed a third-place finish to continue on his positive trajectory within the Croatian National Judo system. He, unfortunately, did not achieve the bronze medal. Whether the parent, especially the father's, cardiovascular and metabolic patterns are consistent could only be answered with repeated measurements across competitions of varying importance. Future research looking to capture the adolescents' expectations will aid in better understanding of parents' expectations and post-competition reactions.

Conclusions

1. The power of wearable technology influences future research directions. In the present investigation, the parents wore the Firstbeat Body Guard 2 device. This device provides a great deal of information concerning stress, sleep, physical activity, and recovery. Wearing the device for several days before as well as after the competitions is a potential area of future research.
2. We can envision this line of research moving from descriptive such as describing parent and even child sleep and stress patterns leading up to competition and the days afterward to randomized interventions for sleep and stress management. We believe that a mix-methods approach should guide future research as it has in the past (e.g., Dorsch et al., 2015).
3. The used technology in this pilot investigation provided unique data. Importantly, the participants reported no lifestyle barriers to wearing the technology or complaints about the technology being a nuisance.
4. The open-ended questions provided insight and complimented the wearable technology data. Incorporating qualitative methodology is vital for future wearable technology research measuring stress, sleep, and recovery analytics.

Conflict of interests

The authors declare that there is no conflict of interests.

References

1. Karpan G, Škof B, Bon M, Šibila M. Analysis of female handball players' effort in different playing positions during official matches. *Kinesiology*. 2015;47(1): 100-107.
2. Suarez-Arrones L, Torreño N, Requena B, Sáez De Villarreal E, Casamichana D, Barbero-Alvarez JC, Munguía-Izquierdo D. Match-play activity profile in professional soccer players during official games and the relationship between external and internal load. *The Journal of Sports Medicine and Physical Fitness*. 2015;55(12): 1417-1422.
3. Morales J, Garcia V, García-Massó X, Salvá P, Escobar R, Buscà B. The use of heart rate variability in assessing precompetitive stress in high-standard judo athletes. *International Journal of Sports Medicine*. 2013; 34(2): 144-151.
4. Suchomel A. A Comparison of Exercise Intensity on Different Player Levels in Table Tennis. *International Table Tennis Federation Sports Science Congress Conference Proceedings*. 2010;6: 79-82.
5. Martin C, Thevenet D, Zouhal H, Mornet Y, Delès R, Crestel T, ... Prioux J. Effects of playing surface (hard and clay courts) on heart rate and blood lactate during tennis matches played by high-level players. *Journal of Strength & Conditioning Research*. 2011;25(1): 163-170.
6. Vaquera A, Mielgo-Ayuso J, Calleja-González J, Leicht AS. Match intensity and heart rate predictors in top level basketball referees during men's Eurobasket. *The Journal of Sports Medicine and Physical Fitness*. 2016;56(9): 1034-1040.
7. Mills A, Butt J, Maynard I, Harwood C. Identifying factors perceived to influence the development of elite youth football academy players. *Journal of Sports Sciences*. 2012;30(15): 1593-1604.
8. Atkins MR, Johnson DM, Force EC, Petrie TA. Peers, parents, and coaches, oh my! The relation of the motivational climate to boys' intention to continue in sport. *Psychology of Sport & Exercise*. 2015;16: 170-180.
9. McCarthy PJ, Jones MV, Clark-Carter D. Understanding enjoyment in youth sport: a developmental perspective. *Psychology of Sport and Exercise*. 2008;9(2): 142-156.
10. Stein G, Raedeke T, Glenn S. Children's perceptions of parent sport involvement: it's not how much, but to what degree that's important. *Journal of Sport Behavior*. 1999;22(4): 591-601.
11. Dorsch TE, Smith AL, Wilson SR, McDonough MH. Parent goals and verbal sideline behavior in organized youth sport. *Sport, Exercise, and Performance Psychology*. 2015;4(1): 19-35.
12. Holt NL, Tamminen KA, Black DE, Sehn ZL, Wall MP. Parental involvement in competitive youth sport settings. *Psychology of Sport and Exercise*. 2008;9(5): 663-685.
13. Harwood CG, Keegan RJ, Smith JJ, Raine AS. A systematic review of the intrapersonal correlates of motivational climate perceptions in sport and physical activity. *Psychology of Sport and Exercise*. 2015;18: 9-25.
14. Lochbaum M, Jean-Noel J, Pinar C, Gilson T. A meta-analytic review of Elliot's (1999) Hierarchical Model of Approach and Avoidance Motivation in the sport, physical activity, and physical education literature. *Journal of Sport and Health Science*. 2017;6(1): 68-80.
15. Lochbaum M, Gottardy J. A meta-analytic review of the approach-avoidance achievement goals and performance relationships in the sport psychology literature. *Journal of Sport and Health Science*. 2015;4: 164-173.
16. Lochbaum M, Kazak Çetinkalp Z, Graham K, Wright T, Zazo R. Task and ego goal orientations in competitive sport: A quantitative review of the literature from 1989 to 2016. *Kinesiology*. 2016; 8(1): 3-29.
17. Lochbaum M, Zazo R, Kazak Çetinkalp Z, Wright T, Graham K, Kontinen N. A meta-analytic review of achievement goal orientation correlates in competitive sport: A follow-up to Lochbaum et al. (2016). *Kinesiology*. 2016;48(2): 159-173.
18. Hogue CM, Fry MD, Fry AC. The differential impact of motivational climate on adolescents' psychological and physiological stress responses. *Psychology of Sport & Exercise*. 2017;30: 118-127.
19. Elliot AJ. Approach and avoidance motivation and achievement goals. *Educational Psychologist*. 1999;34(3): 169-189.
20. Elliot AJ. The Hierarchical Model of Approach-Avoidance Motivation. *Motivation and Emotion*. 2006;30(2): 111-116.
21. Creswell JW. *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. Thousand Oaks, CA: Sage Publications; 2014.
22. Creswell JW, Plano Clark V. *Designing and Conducting Mixed Methods Research*. Thousand Oaks, CA: Sage Publications; 2007.

Information about the authors:

Lochbaum Marc; Ph.D.; <http://orcid.org/0000-0001-7640-7075>; ScopusAuthorID: 6602281694; marc.lochbaum@ttu.edu; Professor; Department of Kinesiology and Sport Management Texas Tech University; Lubbock, Texas 79409-3011 USA; and; Visiting Research Professor; KIHU - Research Institute for Olympic Sports Jyväskylä; Competition and Peak Sports Research Center, Rautpohjankatu 6, 40700 Jyväskylä, Finland.

Prosoli Rebeka; M.S.; <http://orcid.org/0000-0003-2614-673X>; ScopusAuthorID: 57193419706; marc.lochbaum@ttu.edu; Faculty of Kinesiology, University of Zagreb; Horvacanski zavoј 15, 10 000 Zagreb, Croatia.

Barić Renata; Ph.D.; <http://orcid.org/0000-0003-2614-673X>; ScopusAuthorID: 9235921700; renata.baric@kif.hr; Faculty of Kinesiology, University of Zagreb; Horvacanski zavoј 15, 10 000 Zagreb, Croatia.

Cite this article as: Lochbaum M, Prosoli R, Barić R. Cardiovascular and Energy Requirements of Parents Watching Their Child Compete: A Pilot Mixed-Methods Investigation. *Pedagogics, psychology, medical-biological problems of physical training and sports*, 2017;21(6):279-284. doi:10.15561/18189172.2017.0604

The electronic version of this article is the complete one and can be found online at: <http://www.sportpedagogy.org.ua/index.php/PPS/issue/archive>

This is an Open Access article distributed under the terms of the Creative Commons Attribution License, which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited (<http://creativecommons.org/licenses/by/4.0/deed.en>).

Received: 08.10.2017

Accepted: 25.10.2017; Published: 05.11.2017