Introduction to Exercise Physiology & Sports Performance

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Lecture – 35

Body composition and its Implications (Part -3)

Welcome back to this NPTEL course on introduction to exercise physiology and sports performance, to this module on body composition and its implications. So, this is the part 3 of this module and you are with me, Wing Commander Chandrasekara Guru. I am a sports medicine specialist and assistant professor in the field with the armed forces medical services.

So, you will be learning in this module on body composition models, the relation with respect to performance, various body composition assessment methods, and what is being practiced in case of body composition assessment globally. This we have covered in part 1 and part 2 and this part we will be focusing on what are the best practice recommendations with respect to body composition and certain practical scenarios that one can face with respect to body composition.

So, to revise, in the part 1 we discussed about the definition of body composition, how body composition evolved over period of time, the assessment methods that has progressed with respect to various improvement in the technology as well and various models that have been identified over period of time. We discussed about the multi-component model, the different levels, various common terminologies used in body composition, the utilization of body composition in a particular group of sports, various determining factors that influence body composition, how the body composition is related or associated with performance and what is the current evidence that is available with respect to different type of sports and what is the adverse effect of having a perception of ideal body composition with existing sporting culture and the expectation that is there within the sport. So, we discussed about these aspects in the first part of this particular module.

In the second part, we discussed about the categorization of various body composition methods that are available, the utility of these methods, various assessment methods in different sporting setup, how they can be broadly classified into field and the lab methods and the prevalent one that is which are available and practiced across the globe. We saw about the ISAK recommended anthropometry method as a field method. We also discussed about dual energy x-ray absorption method that is DXA scan being used as a body composition assessment method, as a lab method and we also saw bio-electrical impedance-based analysis of body composition which is again a field method. And we discussed the method that is being used or technique that is being used to arrive at these parameters, what are the cautions that one need to keep in mind when you interpret these parameters using these methods, what are the limitations of these methods and advantages of these methods and we discussed why they are prevalent across the globe in assessing body composition. We also saw the cut-off values with respect to the sports athletes based on the survey done by the International Olympic Committee.

We also discussed about the frequency at which the body composition has to be done, and we must measure the body composition. And we also saw what are the various standardization strategies that is being used by these people involved in sports field across the globe.

So, with this kind of revision of whatever we have covered, now let us see what has been a massive shift in the approach towards body composition in the last decade. So, with this survey, we have come to know that this decrease in the frequency of assessment that has been followed or practiced by the experts in the sports field. The predominant method that is being used in the field is surface anthropometry using the ISAK method. This is an increase of more than 23% compared to the previous decade. This use of DXA as a predominant lab method with improvement of more than 11%. Body fat percentage and skin fold measurements using various regression equations have seen a drop in utilization because of lack of standardization. Even though it was a prevalent field method earlier, now there is more than a 40% drop in the utilization of this method owing to lack of standardization. So, priority is moving towards standardization of the technique. This decrease is also seen in the utilization of ultrasound, hydrostatic weighing, and air displacement plethysmography which were gaining popularity in the previous decade. Now that has seen a drop of less than 10% utilization. Also, you see there has been better awareness about the best practice protocols and standardization with respect to the conditions and as well as with respect to the utilization of the equipment and measuring also with respect to the measurers who have to measure. An important aspect or a paradigm shift, I would say, is that the focus has shifted towards the sports nutrition and dietician playing a major role in terms of requesting for body composition analysis as well as measuring the body composition analysis. So, that is an important thing that this decade has seen a major shift in this field.

However, there are certain challenges that have been documented in this particular survey. One is still even though there has been a good amount of positive shift in the last 10 years, there is still evidence of lack of knowledge. There is still that misperception of that change in body weight or body composition can affect performance. Still, that sporting culture and the expectation remains within the key partners or key players in the sports environment. Then, the psychological aspect with respect to the body image has still remained despite the increase in the focus with respect to the sports dietician and sports nutrition in this field. This being more focused or documented adverse effects of this body image thing resulting in disordered eating or eating disorders or in terms of relative energy deficiency in sports. And most of the athletes or the respondents have said that even with the availability of the reports, they lack scientific support in terms of goal setting to achieve a particular intervention to change the body composition. So, that is again an important domain that we need to consider as a challenge that is in front of us in this sporting field. And more dreadfully is that despite the improvement and the knowledge in terms of these sports sciences, there is still practice of weight loss through ill methods. Like using dehydration in a very short-term duration, more commonly in weight-sensitive sports, combat sports, and weight category sports. So, which is again an important factor that needs to be addressed and it is a massive challenge which stays in front of us. So, to negate this or to counter these challenges, IOC had come up with best practice guidelines in the field of body composition assessment and that will be discussed in these particular, subsequent slides.

So, the body composition if the IOC commission has particularly, specially segregated the body composition assessment methodology into various processes. This is a stage-wise process. So,

in the initial step one is the consideration if the individual has to undergo a body composition assessment. If that is so, then the individual's information consent has to be taken. Subsequently, in step three, the appropriate method has to be chosen. Once the method is chosen, then the data collection part comes in, followed by data interpretation along with the other parameters. So, body composition should be part of the comprehensive analysis. Further, a report is developed. Thereafter, the report has to be disseminated and communicated in a proper way to the athlete and the relevant individuals or stakeholders of the performance enhancement or performance monitoring group. Thereafter, a collective decision is made, and an intervention may be given and subsequently has to be monitored as the last step in the process of the body composition assessment. So, here, the athlete enters step one only if there is a sound rationale in terms of assessing the body composition step. That is when the individual enters this particular complete cycle as such. And whenever during the process, if an individual is identified to have some clinical issues with respect to eating disorders or relative energy deficiency in sports kind of symptoms, the individual is immediately exited from the body composition process per se. So, this is a key thing that is required. Based on these steps, we will see now what the bad practices are that are available or being practiced by the sports stakeholders in the sports field and what is recommended by the IOC.

So, the steps one and two correspond to the consideration of an individual for body composition assessment and obtaining informed consent. The bad practice that is being followed in the existing global trend is that generally, the body composition is done en masse in a group. And there is no kind of, it is part of an ongoing basis without any reasoning, to that. There is no particular rationale, just that it is being done. It is now, kind of, ongoing so, it is being done. And there is no screening that is specifically done until and otherwise the individual comes and reports a particular problem. So, there is no proper screening that is there before including or engaging that athlete into the body composition assessment process. So, that is with respect to steps one and two. Moving on to steps three and four where the choice of method that is being used for body composition assessment and data collection. So, you will find that bad practice would be to have an untrained measurer without any standardization in a place where there is no privacy, especially in field methods when it is done en masse or in a group. So, the privacy factor with respect to the individual is gone, both in terms of individual privacy as well as data privacy. There is no concept of taking consent from the athlete or screening for any particular problems. The measurement frequency is also not as per sound best practice rationale. It is based on the ongoing practice or it may be the whims and fancies of any particular coach or trainer or anyone who is involved in the performance. And there is no best practice of standardizing the protocol. That would be a bad practice wherein the output measures or the outcome measures are not reliable. That is a bad practice with respect to steps three and four. When we come to steps five, six, and seven related to data interpretation, and then followed by data reporting, and then followed by data dissemination and communicating the result to the athlete and the other involved stakeholders. So, the bad practice here which is seen or documented are the data is shared broadly, the raw data generally is shared, mainly the body fat percent or the body fat-free mass percent without any correlation with the other parameters, without any interpretation to the sports and training status. The focus is predominantly on the body fat percent. The results does not have kind of any ethical consideration wherein the results are not shared with the athlete, but may be directly shared with the coach without informing the athlete. And the interpretation is most of the cases not being done. So, these are the bad practices at these stages with respect to the data. And the last bad practice with respect to stage

eight, that is the intervention that is being done to manipulate the body composition for increasing the performance and thereafter monitoring, is that the athletes have responded that there is no proper scientific support in terms of providing the result after the body composition assessment and they do not have any particular scientific way or method by which they have to manipulate the body composition parameters. Or, most of the time, the worst-case scenario is the coach who decides or sets goals with respect to the body composition changes that need to be done by the athlete and the frequency of the next follow-up is also decided by the coach. So, that is the bad practice that the IOC committee had put across in this particular study.

However, there has a lot of change that has happened in the last ten years. So, with this kind of positive changes that have happened, they have come up with best practice recommendations involving all these processes in body composition assessment. So, what would be the best practice that would be recommended in stage one and two? A sound rationale. There should be a sound rationale why the individual has to undergo a body composition assessment, and it should not be in isolation; it should always be clubbed with the monitoring of other performance parameters. Coming to the individual aspect, the inclusion of that athlete in such assessment should be more individual-oriented, and the readiness of the athlete has to be documented. In addition to that, all the athletes who get enrolled into the body composition assessment process per se have to undergo a simple screening method by which you can screen out those who are having any problems with a disorder eating, or any features suggestive of relative energy deficiency spectrum. So, that is an important aspect and more so it becomes more athlete-centric where you give informed consent about the aspects related to the body composition assessment. If these things are addressed in stage one and two, it is best practice that needs to be incorporated. Stage three and four where the method of choice of assessment and the data collection comes into play, where the choice has to be made as per the local availability and standardization of the protocol. The measurer has to be trained and should be the preferably trained individual to avoid any observer-related error. The frequency has to be limited to not more than four to six times in a year. As I mentioned earlier, probably once a quarter would be suggested. So, these would be best practice guidelines in these stages. What about the stage with respect to data? So, data privacy is very important. Confidentiality of the data has to be maintained and should be communicated directly to the athlete. The communication again should not be only related to the raw data. It should also be based on the interpretation from the other parameters which are being analyzed or acquired during the process of the comprehensive performance analysis. So, based on the athlete's health with a multidisciplinary team approach, the communication has to be done with the stakeholders with the consent of the athlete. Subsequently, the intervention part and monitoring part again should be more from the performance team or the sports medicine and scientific support team so that the athlete gets the best of the scientific advice with respect to the intervention and the manipulation that is required for increasing performance. And also, the individual's health is also screened during the process of intervention. And the frequency of monitoring also must be decided by this expert team. So, these are the best practice guidelines as listed by the IOC group.

However, this is the ideal situation which we are aiming to reach. So, there will be certain barriers which will prevent from reaching these best practice guidelines. The barriers mainly are related to the resources that are available, expertise that is available. The staffing constraints are obviously a major crunch from an ideal situation, lack of time because of frequent

commercialization and frequent scheduling of competitions. Lack of adequate knowledge as well because of the lack of expertise and the support personnel which are available in the scientific team. Also, the sports culture and the perception also become a major barrier in terms of agreeing or implementing the best practice guidelines. Which obviously can be addressed over a period of time and these gaps can be addressed by improving the number of support personnel, maintaining a good quality of continuing education in terms of certifications. Like, for example, how ISAK certification and the standardization has made a massive shift in the assessment methods. So, that's the kind of intervention in terms of addressing these gaps have to be made at the local level, at the sports organization level as well as at the local athlete and the coach level as well. The elite athletes over the years, in the period of training, attain a certain type of body composition and that alone cannot be considered as the main thing that one needs to achieve even in a sub-elite level of athlete. So, this has happened over a period of time because of the training per se and the experience that the individual has gone through over a period of time. So, there should be a holistic performance analysis in addition to the other parameters when you consider body composition assessment and implementation as intervention.

So, let's quickly go through certain case scenarios. Like Mr. Muthu is a 27-year-old athlete, he is a long-distance runner. He underwent a body composition analysis using the bio-electrical impedance method, and it was part of his routine performance monitoring. The various body composition parameters are shown in this report. So, and he asks you if everything is normal in the report and asks you for advice on further improving the performance. So, when we see the report, we look at the total body weight which is available in the report here. We have the height from the report, 175 cm. We have input the data of 89 cm which was measured before the assessment. And we have also entered the waist value before starting the measurement into the system. So, with these values, the BMI is 22.5 which is within normal limits. The waist tip ratio is 0.85, again within normal limits. The body fat percentage is given by the machine as measured. The body fat is around 10.6% and the lean body mass in this case is 89.4. So, my assessment of this particular case is that the body composition done, we know that lean body mass is directly related or positively related to increasing the running economy and the running performance. So, he is a long-distance runner, so he needs to have good, better lean body mass for good performance. So, in this case, the lean body mass is close to 90% which is good. So, the lean body mass per se is good in this case. We are coming to the body fat percentage. Body fat percentage is negatively correlated with the time to exhaustion. So, more the body fat, the time to exhaustion is kind of reduced. So, that is the correlation. So, in this case, the body fat is also on the lower side, it is around 10.6%. However, the other parameters have to be considered before giving an interpretation to say what he needs to do to improve the performance. So, this is only one part of the coin. So, the other side of the coin also has to be considered. So, with this available data, I would interpret that the body composition assessment in terms of lean body mass and percentage body fat is adequate for a long-distance runner. However, with experience, we have seen that the marathon runners who are at a level of elite level, the body fat percentage is pretty low at averaging even between ranging between 6 to 8 to 9%. 9% is also on higher side, 6 to 8% is generally the range of the long distance runners. So, it is also important to have a normative data for that particular sports with age and gender so that you can compare and give an idea to the athlete and the coach.

Let's move on to the second case. It's the same case. Now here the coach asks, you can further, he says that if he can further reduce the BMI because he has learnt from some of his friends in social media that reducing the BMI will improve the running efficiency and hence, he asks you tips to reduce the BMI to improve the running performance. So, he feels that over the last few months, the performance has been very static and does not show any kind of improvement. So, with the same case, the parameters what we have earlier discussed, my approach to the coach would be, I will explain to the coach that BMI doesn't give a comprehensive idea about the body composition. It's a crude marker. It just takes into account weight and the height. What is BMI? BMI is calculated based on the height and the weight. So, height in meter square divided by the weight in kg. That gives you the BMI. So, however, it's an easier tool to use for general population wherein just with two parameters of weight and height, you can know the BMI and so many studies globally. In fact, WHO also have recommended a certain range of BMI for certain lifestyle related diseases like obesity or cardiovascular diseases. So, for general population, BMI, okay, for screening and kind of prognosis of developing a disease or not. But for an athlete, especially a long-distance runner who's having a coach, a dedicated coach who's come to a sports science setup to understand further improvement in performance, BMI is a crude marker to give any input. So, there may be some correlation studies which have proved that reduction in BMI has increased. So, we don't know whether it is reduction in the body fat or it is reduction or increase in the body mass. So, that is an important thing that needs to be explained to the coach. Then I would obviously go through the report, interpret it along with the other performance parameters. And I would also, based on the available report, it is only the lean body mass. The lean body mass as per me, it is good. So, further, I would advise the athlete and the coach to undergo certain performance measurement test because the coach is approaching you for an answer because he's been giving the training, but the performance has become static. So, you need to, as a performance team member and a sports medicine or sports science faculty or contributor to the performance of the athlete, it is essential that we need to have the other performance parameters. So, commonly used performance parameters are the VO2 max in long distance learning, lactic threshold estimation, and other important aspects with respect to the nutritional intake, whether the individual is taking adequate nutrition for the output that is undergoing because of the training. Also, the sleep pattern. Sometimes sleep pattern also gives a clue into the performance analysis. Also, the training load analysis, how much is the load and how is the individual responding to the load. So, these aspects have to be studied in total as a holistic manner to come to a conclusion and accordingly a suggestion can be given to the coach to further monitor the progress of the individual with respect to the training.

Let's move on to a case scenario 3, wherein the same individual, he participates, he is a boxer. Now this individual, Mr. Muthu is not a runner, he is a boxer. He is a 27 years old male and he has come for his body composition assessment during his routine performance monitoring. He participates in a welter weight category, which is the 64 to 69 kg weight category, and he asks you about the body composition result. Obviously, since he has undergone a test, he would be interested in knowing the results of the test and he also keeps saying, he says that that he keeps his body weight in the range between 69 to 71 kg and he asks for any kind of advice to do to further maintain or improve the performance. With the same parameters, we know that his body fat percent is 10.6% and lean body mass is 89.4%. Here, his body weight is 69 kg, which is as required for the sport, so he is in the ideal body weight category. When the game happens, he should be less than 69 kgs, not even 100 grams more or so. So, 69 kg is his weight, so he is

perfect. Moving on to body composition, his lean body mass is close to 90%, which is good. We need to now acknowledge the efforts the athlete has put in to maintain this particular body composition as well as maintain the weight and more so, the individual has said that he maintains the weight between two kgs only, 69 to 71 kg, which is again very good considering the fact that when the body weight loss is less than 3%, the performance improves in fact. So that is a very good thing. And you need to also explain in the recommended weight loss regime that in weight sensitive sports, which is being scientifically proved. So, the scientifically documented interventions with good effect or positive relation in performance is that 500 to 800 grams of weight loss over a week. And if it is continued over a period of more than four weeks, then it is found that it improves in fact the performance and also aids the athlete to participate in the expected weight category. So, in this individual, all you need is to just given the interpret the results in correlation with the other performance parameters and then motivate the individual to continue it further so that his performance will take constant or further increase.

So, the takeaway from this module on body composition and its implication is that body composition analysis is one among the other performance parameters, it is not the lone parameters that one needs to consider. So, the concept of ideal body composition for performance is more of a perceptional thing. The frequency of testing should be not more than four to six times per year. And the protocol that needs to be used in whichever method of choice of the assessment of body composition should be standardized. And if you use a particular method, try to continue using the same method for the longitudinal monitoring so that the precision is maintained. And during the process of measurement, it is advised or best practice would be to have trained measurer and interpret the results in conjunction with the other performance parameters and explain it, communicate it in a better way to the athlete and the involved coach and the trainer. The assessment data sharing as well as the intervention, everything should focus on athlete only. When you prioritize athlete health as the most important one, then everything will slowly fall into place. That should be the best practice approach from sports science or a sports medicine or a performance team towards the body composition and its implication in sports.

So, for those of you who are interested in further in-depth understanding and reading of the topic, I would bring your attention to these good useful resources available.

Thank you.