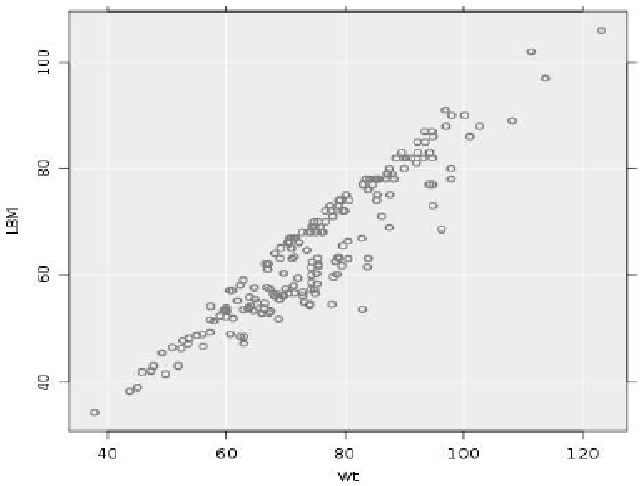
Student 3: Low Merit

NZQA Intended for teacher use only

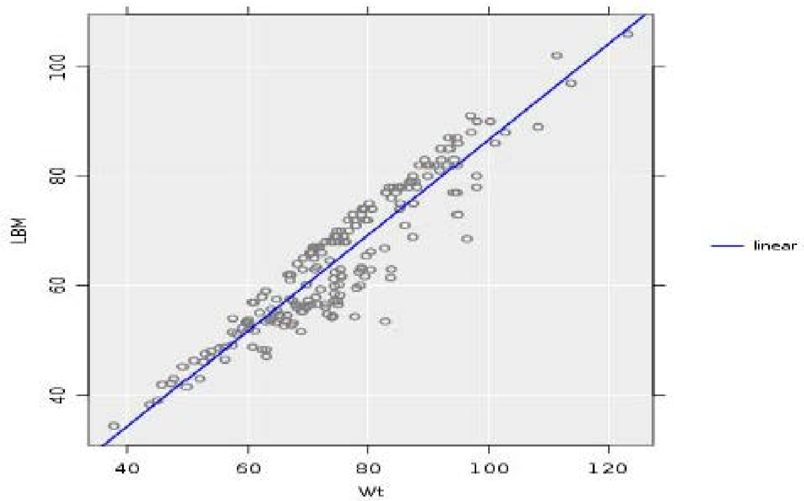
I am investigating if there is a relationship between weight in kg and lean body mass (LBM) for the athletes in the data set supplied from the Australian Institute of Sport. 1
The weight of a person is made up of body fat and lean body mass and according to Bodybuilding.com the LBM is the amount of weight you carry on your body that isn't fat. Erin Coleman, R.D., L.D. in an article on Livestrong.com says that "Lean body mass includes more than two-thirds water, according to Medline Plus, and the remainder other lean tissues such as muscle, organs and bone" (http://www.livestrong.com/article/175858-the-average-lean-body-mass/#ixzz26y4L97ck).

LBM affects athletic performance, appearance and weight. In some sports the amount of LBM can affect your performance and this information is likely to be useful to the coaches and trainers. http://www.humankinetics.com/excerpts/excerpts/normal-ranges-of-body-weight-and-body-fat.

I have drawn an initial scatter plot using weight in kg as an explanatory variable and LBM as the response variable.



From the graph the weight in kg and LBM have a positive relationship which means that as weight in kg increases the LBM tends to increase. This may be because heavier athletes have heavy organs or muscles. The points are grouped closely together although the data for weights over 102kg are more spaced out they appear to be following the same line. 3



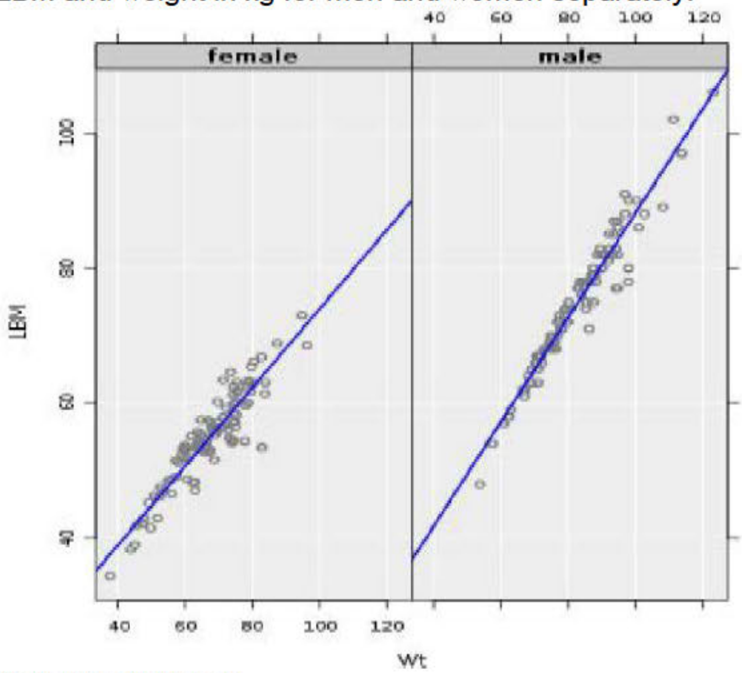
Wt versus LBM

The trend line equation is $y = 0.8737x - 0.6627$. 4
The relationship is strong because the points are close to the regression line. 2
The model proposed suggests that as the weight increases by 1kg, the LBM increases by 0.8737kg.

Prediction.
According to the Australian Bureau of Statistics the average weight of a man of average height is 85.2kg and a woman of average height is 70.1kg. (http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/4841.0Chapter22011).
While these will not be the same necessarily for the average weights of high performance athletes I will use a weight within this weight range to predict the LBM of athletes.

I will use the weights of 75kg and 100kg to predict what the LBM will be. Since the linear model appears to fit the data well I will use this to make my predictions. For the prediction, I substituted the weights into y = 0.8737x – 0.6627. ④
y = 0.8737*75 – 0.6627 = 64.8648 = 64.9kg which is above the data points (LBM values) near this weight,
y = 0.8737*100 – 0.6627 = 86.70739 = 86.7kg which is in the middle of the data points (LBM values) for this weight on my graph.

I wonder if there are differences in the relationship between male and female athletes and also between different sports in the data set. I will now look at the relationship between for LBM and weight in kg for men and women separately.



The linear model for males is y = 0.7732x + 10.851 and for females the linear model is y = 0.5839x + 15.571. For both of these relationships the points are close to the regression line. Looking at the model proposed for the men the data points appear to be scattered more closely to the line than that for the men and women together and I think it is likely if I use this model to predict the LBM for a male athlete the results will be more reliable. Visually the scatter on the graph for the female athletes' is similar to the one with all the men and women together although there are no data points beyond a weight of 97kg. ③

Male predictions:
75kg, LBM = 0.7732*75 + 10.851= 68.841 = 68.8kg.
100 kg, LBM = 0.7732*100 + 10.851 = 88.171 = 88.2kg.
As this model looks to be a better fit than the combined model I think that these predictions are fairly accurate. ④
Female predictions:
75kg, LBM = 0.5839*75 + 15.571 = 59.36 = 59.4kg. Looking at the other data points (LBM) around this weight, I think that this is a reliable prediction for the LBM.
100 kg, LBM = 0.5839*100 + 15.571 = 73.961 = 74.0kg – there aren't any female athletes of this weight in the graph so this prediction may be more unreliable than those for weights of less than 100kg.

I think that the combined linear regression model fits the data investigated well but the separate models are likely to be more reliable and appear to be a better fit. This information could be useful to coaches and trainers. I didn't look at how well these models might fit the 'average population' or how the different sports the athletes took part in may influence the relationships.