

Hong Kong Student Science Project Competition 2022

Template of Extended Abstract (Investigation Design Proposal)

(Word Limit: 1,000 words, Pages: 2 pages only)

Team Number: SDBC170

Project Title: Is meat ingestion (i.e. chicken breast) as effective as protein blend in increasing muscle strength ?

Project Type: Investigation Design Proposal

To our best knowledge and after thorough literature research, as at 04/03/23 , there are similar works. If there are, the reference links are as below:

1. Ewy, M. W., Patel, A., Abdelmagid, M., Elfadil, O. M., Bonnes, S. L., Salonen, B. R., Hurt, R. T., & Mundi, M. S. (2022b). Plant-Based Diet: Is It as Good as an Animal-Based Diet When It Comes to Protein? *Current Nutrition Reports*, 11(2), 337–346. <https://doi.org/10.1007/s13668-022-00401-8>
2. Potue, P., Chiangsaen, P., Maneesai, P., Khamseekeaw, J., Pakdeechote, P., Chankitisakul, V., Boonkum, W., Duanghaklang, N., & Duangjinda, M. (2022b). Effects of Thai native chicken breast meat consumption on serum uric acid level, biochemical parameters, and antioxidant activities in rats. *Scientific Reports*, 12(1). <https://doi.org/10.1038/s41598-022-18484-2>
3. Davison, B., Quigg, R., & Skidmore, P. M. L. (2018b). Pilot Testing a Photo-Based Food Diary in Nine- to Twelve-Year Old- Children from Dunedin, New Zealand. *Nutrients*, 10(2), 240. <https://doi.org/10.3390/nu10020240>
4. Cribb, P. J., Williams, A., Stathis, C. G., Carey, M. P., & Hayes, A. (2003b). Effects of Whey Isolate, Creatine, and Resistance Training on Muscle Hypertrophy. *Medicine and Science in Sports and Exercise*, 39(2), 298–307. <https://doi.org/10.1249/01.mss.0000247002.32589.ef>
5. Grgic, J., Lazineca, B., Schoenfeld, B. J., & Pedisic, Z. (2020b). Test–Retest Reliability of the One-Repetition Maximum (1RM) Strength Assessment: a Systematic Review. *Sports Medicine - Open*, 6(1). <https://doi.org/10.1186/s40798-020-00260-z>
6. Drummond, M. J., & Rasmussen, B. B. (2008). Leucine-enriched nutrients and the regulation of mammalian target of rapamycin signalling and human skeletal muscle protein synthesis. *Current Opinion in Clinical Nutrition and Metabolic Care*, 11(3), 222–226. <https://doi.org/10.1097/mco.0b013e3282fa17fb>

The enhancement our project has made for the existing related products or research is summarized as below:

Previous studies mainly compare the effects of different protein sources on physical performance, including the advantages and disadvantages of ingesting animal and vegetable protein sources (casein, whey protein and isolated soy protein) on athletic performance. However, little data exists to support the notion that chicken breast or protein blend is a more superior protein supplement than the other.

I. **Background**

Muscular strength is defined as “the ability to exert a force on an external object or resistance” .Protein ingestion is a proven dietary strategy to sustain exercise performance. Protein blends often consist of various types of proteins with different digestion rates to provide athletes with the most efficient fuel for their training. On the other hand, chicken breast has a diverse content of nutrients, such as omega-3 fatty acids that can also improve sports performance. However, there are limited studies comparing the effect of these protein sources in the same group of athletes.

II. **Objective(s)**

Firstly, to find out the effect of chicken breast on increasing muscular strength. There is still not much information on the correlation between the two in particular. Thus, this study aims to provide a brief, if not deep enough, concept of how increase in muscle strength is impacted from the ingestion of chicken breast. Moreover , this research is conducted to compare the effectiveness of protein blend and chicken breast consumption on the increase of muscular strength , so as to facilitate the development of energy fuel alternatives.

已註解 [1]: You have to limit to 2 pages. Therefore, be precise and concise in your language.

已註解 [2]: - Provide background information of project and/or state the problem to tackle
- Provide highlights of the literature review with the support of pertinent and reliable references
- Provide an overview of work and mention the research gap that the project is trying to fill

III. Hypothesis

Chicken breast is an excellent source of protein, which implies that constant muscle protein synthesis can be maintained over a prolonged period. Moreover, production of leucine and essential amino acids will be relatively higher for animal-based diets, thus lead to increased anabolic potential and muscle protein synthesis. Therefore, chicken breast ingestion is hypothesized to be as effective or even more effective than protein blend in increasing total muscular strength. This can be proved by the higher increase in muscular strength after participants undergo 9-weeks of normal meal intake with chicken breast supplementation.

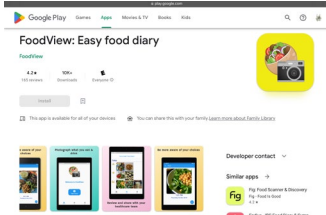
已註解 [3]: - Propose an explanation for a phenomenon and stating how the hypothesis can be tested by experiments

IV. Methodology

40 male participants of approximately 57-70 kg of 19-30 years old will be recruited for the experiment.

Baseline Measurement:

Two weeks prior to the experiment, participants will record their food consumed at each eating occasion using a food diary app, named FoodView. Participants will be given verbal instructions on how to complete the photo-based food diary. Photographs will be collected on the app to estimate the proportion of food consumed. Brand names of food and drinks are suggested to be included to improve the accuracy of the final results. Participants will take a measurement of their maximal muscular strength by evaluating their 1RM, which is defined as the maximal weight that can be lifted once with correct posture and technique by participants. The 1RM test is proven to be a reliable test for assessing maximal muscular strength (Jozo Grgic et al., June 31, 2020) The participants will then be separated into four quartiles according to their 1RM values, this is to show the possible correlation between 1RM values and the effect of protein supplementation.



已註解 [4]: - List out the materials to be used
- Describe the experimental protocol including the set-up of control experiment (if any), repeated experiment (if any), and its scientific theory
- Indicate with the support of reasons, the analysis to be used in the investigation

Experimental Setup:

This will be a randomised experimental design. Participants will be requested to follow and repeat their own food diary for two nine weeks duration , each duration with either chicken breast or protein blend as supplementation. Based on their body mass, participants will be recommended to take chicken breast or protein blend of 2.3-3.1g/kg per day. There will be one month of interval (original diet without additional supplementation and with continued training) in between the two 9-weeks of controlled diet , as to ensure the effect on 1RM value of participants is solely due to one kind of supplementation only.

Participants will be asked to follow the below program for 1 hour on 4 days per week for a duration of 9 weeks for each kind of food supplementation.

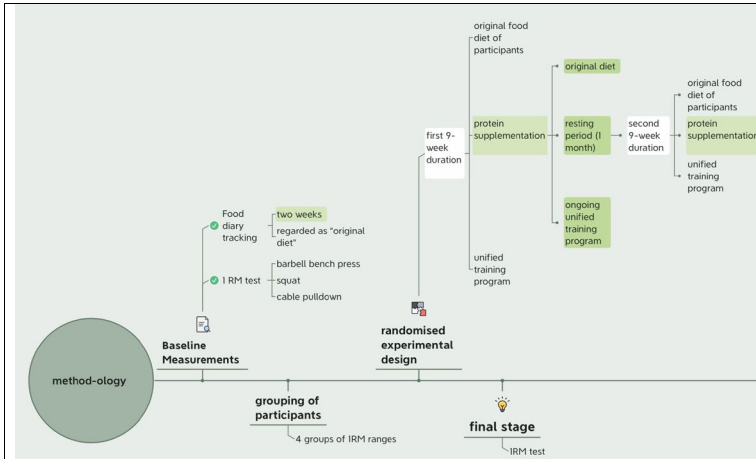
已註解 [5]: need amendments and missing description of interval between each 9-week period of food diet

- Warm-up on a cycle ergometer /treadmill (5mins)
- Flexibility training (5-10mins)
- Resistance exercise (~60mins)
 - twelve repetitions at 80% of 1RM
 - 1st day: pectoralis and triceps exercises
 - 2nd day: back and biceps exercises
 - 3rd day: deltoids
 - 4th day: quadriceps, hamstrings, and calves

Participants will be asked to perform the 1RM test after each 9-week training to investigate whether there will be an increase in muscular strength.

已註解 [6]: 9 weeks for chicken breast, and then 9 weeks for protein blends? Will participants be randomised?

已註解 [7]: The participants will have 9 weeks of chicken breast followed by 9 weeks of protein blend consumption. They will be of the same group of participants.



Scientific theory

Some substances in protein sources are found to be boosters of muscle protein synthesis, for example leucine, creatine, and essential amino acids, can stimulate the synthesis of muscle protein and muscle hypertrophy, leading to increase in muscle strength.

Increased protein intake contributes to increased muscle strength when coupled with resistance exercise.

Muscle preservation is increased when protein intake is during negative energy balance. (i.e. muscle protein synthesis < muscle protein breakdown). Ingestion of protein during negative energy balance coupled with resistance exercise give beneficial effects to protein kinetic stimuli, resulting in the enhanced synthesis of new muscle protein, providing the conditions for muscle growth. This facilitates the building and repairing of muscle tissue, which improves the body's ability to adapt to strength training.

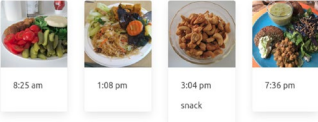
Some substances in protein sources are found to be boosters of muscle protein synthesis, for example leucine, creatine, and essential amino acids. They are able to stimulate the synthesis of muscle protein and muscle hypertrophy, leading to increase in muscle strength. As stated in a study conducted by Michael J. Drummond et al., it is proved that the anabolic actions of leucine and insulin has a major role in activating independent intracellular signaling pathways which converge at the mammalian target of rapamycin. It can then phosphorylate downstream effectors such as S6K1 and 4E-BP1 to promote translation initiation and elongation for protein synthesis. Other than that, isoleucine, valine are also important for the building of proteins. By maximizing protein synthesis, muscle mass and strength can be increased consequently.

V. Expected Results and Impact of research

已註解 [8]: still missing: description and demo of how to represent data collected and results

FoodView Viewing shared photos Grouping Backup

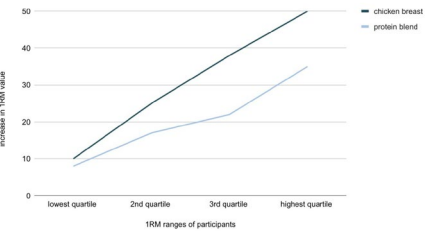
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Example of food diary
<https://foodview.app>

A line graph will be plotted by using the data collected as shown below..

effect of chicken breast and protein blend supplementation on the increase in 1RM value in participants of different 1RM ranges



1RM ranges of participants	chicken breast (increase in 1RM value)	protein blend (increase in 1RM value)
lowest quartile	10	10
2nd quartile	25	18
3rd quartile	40	25
highest quartile	50	35

Though there already exists a lot of energy fuels for athletic use, however there is the need to keep diversing the options and alleviating the effectiveness of sport fuels at the same time. This research is looking to provide a better alternative to protein blend in reference to the results obtained from the experiment. This study targeted developing protein fuels that are formulated using chicken breast and some original components in protein blends. Such mixtures can be beneficial for bodybuilders, serving as an energy source and stimulation for alleviating skeletal muscle hypertrophy and strength. This research is hoping to be able to produce better sports fuels characteristics and discover breakthroughs in sports foods.

VI. Conclusion

Chicken breast is more effective in increasing muscle strength than protein blend. Due to the higher digestibility and amino acid absorption kinetics in whole food proteins, chicken breast is found to have a higher effect on the increase in muscular strength. While there is growing popularity of whey-based protein sources, such as protein isolates derived from soy and wheat, they are still relatively lacking in stimulating muscle protein synthesis. There are limited studies on whey-based protein sources and muscle protein synthesis. Thus, whether the composition of proteins in whey-based protein products can be altered to provide optimal muscle protein synthesis still remains inconclusive and to be addressed in further studies.

* Our project is developed based on our school's previous project and the enhancement is as below:

Not applicable.

已註解 [9]: - Make a conclusion of the design project and the way forward of the research