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Different protein consumption and resistance training effect on body composition indicators

Abstract

Background: body composition, is considered as an indicator for general health. Increase in body wight and fat mass, especially visceral fat mass and decrease in lean body mass, can lead to cardio-metabolic disorders.

Methods: 40 inactive and young individuals were randomly divided into 4 groups as following: 1) plant- based protein, 2) animal-based protein, 3) resistance training and 4) control group. Participants were asked to follow protein intake as the instruction for their groups for 3 weeks and participants in resistance group, participated in resistance training sessions for 3 weeks, 3 sessions each week, which lasted for 45 minutes.

Results: there was a significant decrease for body weight in the interventional groups (p=0.001). fat mass, decreased significantly in interventional groups (p=0.001) and the most effective intervention for decrease in body weight and fat mass, was resistance training. Resistance training and animal-based protein intake, improved lean body mass significantly (p=0.001), although, plant-based protein intake, decreased lean body mass.

Conclusion: both plant-based and animal-based protein intake can improve body composition in inactive individuals. Plant-based proteins, should be consumed in larger amount in order to provide sufficient amino acids. Resistance training can be considered as effective intervention for body composition improvement, especially in combination of modified dietary pattern and protein intake.

Keywords: protein, diet, resistance training, body composition, health

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Introduction

Proteins are assumed to improve muscle protein turn over and help to improve muscle structure. There are two protein sources in dietary pattern including plant-based and animal-based. It has been suggested that protein synthesis will improve more, when animal-based source of proteins are consumed in comparison to plant-based protein sources.[1] While, protein consumption is strongly believed to improve body composition, the results from studies have indicated inconsistent results. These results will become more challenging among inactive individuals who are not used to physical exercise of any regular training. It has been suggested that the consumption of essential and branched-chain amino acids (EAA/BCAA) will improve protein homeostasis, while some other studies have suggested no improvement following protein consumption or supplementation.[2]

Different sources of proteins and body composition

Proteins, are dietary sources with several beneficial effects including satiety, metabolism regulation, protein turnover regulation and body composition improvement which may regulate metabolism and/or homeostasis in the body. While it is believed that animal-based dietary sources especially diary product may increase protein synthesis and energy expenditure in the body, the results from some studies, have not find clear difference for animal-based and plant-based proteins including legumes, soy and it deraitives on body composition, but it is generally believed that proteins may increase energy expenditure, satiety and fat loss, which may improve body composition.[3]

Adequate dietary protein intake and providing essential amino acids for the body, is crucial for health. Animal-based proteins are believed to provide more essential amino acids for the body and can have more beneficial effects, as they are more digestible and absorbable in the body, although plant-based dietary sources of protein may bring these beneficial effects, especially when consumed in larger amounts.[4]

Protein consumption may guarantee body growth, body energy expenditure homeostasis and improve body composition via several pathways including AMPK/TOR/PI3K signaling pathways which may regulate general homeostasis, as a result.[5] It has been suggested that this improvement in body composition and homeostasis can be provided by both animal-based and plant-based dietary protein sources.[6] This result is in parallel with the results from recent studies, as several studies have approved the beneficial effect of plant-based protein sources on body weight, inflammation, insulin resistance and prevalence of diabetes type 2. Moreover, it seems that plant-based proteins can induce thermogenic genes expression and modify white adipose tissue (WAT) and brown adipose tissue (BAT).[7] Studies that have prescribed plant-based dietary patterns, have suggested that plant-based dietary sources and vegetarian diet may improve body weight, body composition and insulin sensitivity which is independent from energy intake.[8] Although, it is believed that animal-based protein consumption may improve body composition and lean body mass, it seems that the protein source which is consumed, may have different effect, for instance, it has been suggested that daily poultry and egg consumption may improve muscular function, while red meat consumption had negative effects on body composition and fat mass, which may increase the beneficial effects of plant-based protein sources including beans, tofu, poultry and eggs in comparison to other protein sources.[9]

Resistance training effect on body composition

Resistance training, has been introduced as an effective training method to improve body composition. It seems that beneficial effect

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of this training, may be better than aerobic training. Studies which have focused on the effect of resistance training with dietary changes and modifications, have suggested that dietary changes may affect the efficacy of resistance training on body composition.[10] Furthermore, resistance training may improve physical fitness indicators, muscular fitness and body composition.[11] The improvement in body composition, especially in visceral fat mass, may lead to beneficial health effect including cardio-metabolic health, aside from weight loss.[12] Resistance training can improve energy expenditure components including resting metabolic rate (RMR), improve body weight maintenance and decrease fat mass.[13,14]

According to inconsistent results from the efficacy of plant-based and animal-based protein sources and as it was believed that animal-base protein sources may bring more beneficial effect on body composition and nutrient homeostasis,[15] the purpose of this study, was to evaluate and compare the effect of plant-based protein versus animal-based protein consumption and resistance training on body composition in inactive young individuals.

Methods

Participants

Invitation letters were provided for sport centers. Volunteers were invited to participate at the introduction session. Participants of this study, were 40 individuals (aged 20-35 years) without any physical exercise or regular physical training during last year. This study lasted for 4 weeks which included one week of introduction and assessment procedure following by 3 weeks of intervention in August 2022. During the introduction session, the study purposes and procedures were explained to all of the participants and they were told, they are allowed to leave the study whenever they were reluctant to continue cooperation. At the end of introduction session, letter of consent was taken from the participants and they were randomly divided into 5 groups as following: 1) plant-based protein, 2) animal-based protein, 3) resistance exercise and 4) control group. All of the study protocols were designed according to ethnical guidelines.

Inclusion criteria

Participants were allowed to participate in the study in case of following criteria:

- Not having any inhibition for physical activity
- Not having any dietary restriction
- Not having any food allergies
- Not having physical activity and/or exercise experience within past year
- Not having medical complication and/or medication

Exclusion criteria

Participants were excluded from the study in case of following criteria:

- Any physical and health complication that inhibit participants from physical activity and/ot following specific dietary pattern
- No tendency to continue participation in the study

Health assessments

Before the interventions, all of the participants were asked to participate in medical assessment session. Blood samples were collected from anterior cubital vein in order to assess biochemical indicators including blood glucose (FBS), lipid profile, hepatic enzymes, ferritin, TIBC, serum vitamin D, serum vitamins and minerals. All of the participants were examined by general practitioner and cardiologist.

Plant-based protein group

Participants in plant-base group, were asked to do not consume any animal-based protein including meats, eggs and dairy product for 3 weeks. As we wanted to assess the efficacy of plant-based protein sources with animal-based, the recommended protein intake for plant-based protein group, was the same as recommended guideline for animal-based protein intake.

Animal-based protein group

Participants in animal-based protein group, were asked to do not consume any plant-based proteins including soy, nuts, tofu, for 3 weeks.

Resistance exercise group

Participants in this group, recruited resistance training including warm up, dumble press, leg press, bench press, elastic bands training and cold down, for 3 weeks, 3 times per week 45 minutes for each session.

Body composition analysis

Body composition, including body weight, percent of fat mass and percent of lean body mass, were assessed using body composition analyzer before and after the intervention.

Results

The results from this study, have been indicated in Table 1. The results from this study, have indicated that resistance training, was the best intervention for body composition improvement including body weight, fat mass and lean body mass.

Table 1 Participants body composition indicators, before and after the intervention

variable		Plant-based protein	Animal based protein	Resistance training	control	P
Age (yrs)		26± 5.8	28.3±3.5	29.9±4.5	27.1±2.1	
Stature (cm)		178.2±6.4	172.3±7.6	176.8±23	177.5±8.4	
Body weight (kg)	Pre-test	82.4±11.2	86.3±10.9	84.3±16.5	86.7±12.6	0.001
	Post-test	76.4±8.7	74.3±7.5	72.1±6.8	88.4±11.9	
Fat mass (%)	Pre-test	25.4±11.2	27.2±11.1	26.8±32	27.4±12.1	0.001
	Post-test	21.4±9.8	22.3±8.9	19.7±7.6	28.4±14.1	
Lean body mass (%)	Pre-test	12.1±2	11.9±3.4	12.4±4.5	11.8±5.1	0.001
	Post-test	11.4±3	13.5±5.4	15.3±6.4	12.1±4.8	

The results from this study, has suggested significant improvement in body weight in all the experimental groups (p=0.001) the most effective intervention belongs to resistance training. Although body weight decreases in both plant-based and animal-based protein diets,

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the effect of animal-based protein diet, was better than plant-based diet protein.

The results from this study, have suggested that fat mass percent has decreased in all of the interventional groups (p=0.001) and represented the most reduction for resistance training group. Fat mass percent reduction, was higher in plant-based proteins in comparison to animal-base-d protein.

Lean body mass percent, was improved significantly in resistance training group and animal-based protein diet (p=0.001). Lean body mass percent decreased in plant-based protein diet group.

Discussion

The purpose of this study, was to evaluate and compare the effect of plant-based and animal-based dietary protein sources and resistance training on body composition factors in inactive individuals. The results from this study, have indicated a significant decrease in body weight in all of the interventional groups in comparison with control group. The most effective intervention for body weight improvement belonged to resistance training. Fat mass decreased in the interventional groups and the most effective intervention for fat loss, was shown in resistance training group. Lean body mass, was another indicator for body composition which was assessed in this study. The results have indicated a significant increase in lean body mass for resistance group, despite there was a reduction in lean body mass in participants who consume plant-based proteins.

It is apparent that protein consumption will improve protein turnover and body composition which may support muscular components.[1] The results from recent studies regarding the efficacy of plant-based and animal-based dietary protein sources, are in consistent, but it is accepted that EAA and BCAA are important for protein homeostasis especially in individuals with low level of physical activity.[2] This is a reason for more popularity of animal-based protein sources in comparison with plant-based which has led to this hypothesis that animal-based proteins are better sources than protein-based proteins because they may provide more EAA, although plant-based proteins may improve protein homeostasis and bring similar effects, especially when consumed in larger amounts.[4] Adequate protein intake, independent from its dietary sources. May improve body weight and body composition via AMPK/TOR/PI3K signaling pathways.[5,6] The modification in body composition indicators, may also be as a result of WAT and BAT gene expression.[7] Although there is controversy regarding plant-based proteins and their possible effect on body composition, it has been suggested that plan-based proteins may improve the related indicators, independent from body weight[8] and there may not be necessary to provide all amino acids and proteins by consuming animal-based proteins, as it has been indicated that different animal-based proteins may have different effects and poultry, egg, legumes, beans and tofu may be better than red meat proteins.[9]

Resistance training, has been introduced as an effective training method, which may have beneficial effects of health.[10] Resistance training can improve body weight, body composition, physical fitness and metabolic rate especially RMR and will help to reduce visceral fat which may improve cardiac-metabolic health, as a result.[11-14]

Conclusion

Both plant-based and animal-based proteins can have beneficial effects on body composition. As plant-based proteins seem to provide less EAA in comparison to animal-based proteins, it is suggested to be consumed in larges portions. Resistance training can be recruited as an effective physical exercise program even for individuals without exercise experience, especially when accompanied by a modified dietary pattern which provides sufficient protein. It can be concluded that resistance training plays more effective role on body composition improvement in comparison to protein consumption which can be explained by the cell signaling pathways. As proteins may have beneficial effects on body composition, it can be suggested to be consumed along with resistance training in order to improve the efficacy of training. Further studies are suggested in order to evaluate the effect of different dietary sources of protein along with resistance training.

Limitations

The limitation of the study are listed as following:

- Low duration of intervention
- Small sample size
- Low control on participants dietary and physical activity pattern during the times that they were not supervised.

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None

Conflicts of interest

All authors declare that there is no conflicts of interest.

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