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Anthropometric Indicators Among Adolescent Female Players After Soy Supplement in Chhattisgarh India

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ABSTRACT

Adolescence is a transitional phase from childhood to adulthood. It is a period of development as the gain of anthropometric measurements is increased over this period. India is a country with different tribal groups and Bastar district is a tribal belt of Chhattisgarh state in India. The nutritional status is a major concern among adolescent girls, which affects growth and development and forms basis of adulthood, dietary supplements can play an important role to address the concerns. The study aimed to explore the effect of soy supplement on the anthropometric measurement of tribal girls. A total of 120 female players aged 12 to 18 years from a residential school where the female players take part in sports training as well as attend the school Khel Parisar Kanker (KPK) from the tribal area and female players of Sports Authority of India (SAI) of urban area were selected for the study. Female players of KPK and SAI were divided into Experimental Group (EG) (N=30) and Control Group (CG) (N=30). Soy Supplement in form of Soy Ladoo was provided to the experimental group from August'2018 to March'2019. Before and after experimental design with control groups was used in the study. Height, Weight, Mid Upper Arm Circumference (MUAC), Waist Girth (WG) were measured and BMI was calculated. ANCOVA and trend analysis were used to analyse the data. It was found that Anthropometric measurements (MUAC, WG and BMI)increased significantly in EG than CG in KPK and SAI female players. An upward trend was observed and can be concluded that soy supplement was effective in improving anthropometric measurements.

Keywords: Soy supplement, adolescent girls, anthropometric measurement, Khel Parisar Kanker (KPK), Sports Authority of India (SAI)

INTRODUCTION

A balanced diet is an essential element in the life of one and all, it needs special attention during the adolescent period as it is the period of the growth spurt and developmental stage where physical, physiological and mental changes take place, which requires that each cell of the body is well nourished to work optimally when these adolescents take part in sports the nutritional requirement needs much more attention asper increased demand of the physical activity for optimal performance.

The "dietary supplement" means a product (other than tobacco) intended to supplement the diet that contains one or more dietary ingredients, including a vitamin, minerals, a herb or other botanical substance, an amino acid, a dietary substance, for use by man to supplement the diet by increasing the total dietary intake, or a concentrate, metabolite, constituent, extract or combination of any of aforementioned ingredients.[1]A dietary supplement is also known as a food supplement or nutritional supplement, is a preparation to provide nutrients when it is lacking in the diet.[2]

Soy supplement is a preparation of soybean has global importance and economic value. It has an excellent source of high quality of all 8 essential amino acid such as cysteine, tryptophan, leucine, isoleucine, lysine, valine, histidine, phenylalanine. It has soluble carbohydrates, dietary fibres, Omega 3 and Omega 6 fats. It also contains minerals such as calcium, iron, copper, zinc, magnesium, phosphorus, potassium and flavonoids which are important for growth and to build lean body mass.[3]

Adolescence is an intermediate phase between childhood and adulthood. According to WHO the age ranges from 10 to 19 years. It is a period of rapid growth and demand higher nutrition because up to 50% of the height and skeletal mass is gained during this period. Anthropometric measurements are used commonly to assess nutritional status. It displays health, nutritional status and anticipates performance. It also reflects the growth pattern of individuals.

In India adolescent girls aged11 to 18 years are about 16.75%of the total female population.[4] Their nutritional status is low and nutritional anaemia is a major health problem, The National Family Health Survey 3 (NFHS 3) data suggests that 56% of girls of 15 to 19 years were anaemic.[5]

Chhattisgarh was established on 1st November 2000 by splitting ten Chhattisgarhi and six Gondi districts of Madhya Pradesh. Bastar district is a tribal belt of Chhattisgarh. The major tribes are Gond, Batra, Muria, Abujmaria, Bison, Hornmaria, Halba, Dhurva.[6] Almost 70% of the population are tribals. They are an important part of the state population and lives mainly in the dense forest of Bastar. They depend upon primitive agriculture practices and often face problems like scarcity of food, poverty, health problems and improper education facilities.

The plethora of studies revealed that anthropometric measurements were significantly lower among adolescent girls. Kapoor and Aneja reported that 35.5% of adolescent girls aged 11 to 18yrs of Delhi are undernourished.[7]Adolescent girls were found to be 3 to 10cm shorter and 3 to 15 Kg lighter than their U.S. counterparts.[8] A study in nine states of India reported that about 42% of adolescent tribal girls were undernourished.[9] In another study, 58.44% stunting and 72.71% wasting was found in tribal girls.[10]Sharma et al. (2013) report that 42.6 % of girls were undernourished.[11]Venugopal et al (2016) state that weight and height, when compared with NCHS 1987, CDC 20-07-2010, ICMR 2010 growth reference and all the anthropometric measurements, were significantly lower among adolescent girls of Chhattisgarh.[12]Various other studies also revealed that the prevalence of lower nutritional status is common in adolescent girls in Chhattisgarh (C.G.). Kurrey et al. reported underweight 32.5%, stunting 22% and thinness 24% among Bihor tribal children.[13]A Study has reported 57.1% of children to be thin in the sample.[14] Low BMI was reported in Gond tribes of C.G.[15] Lower weight and height were reported in Kamar children in almost all ages.[16]

Insufficient protein intake has been shown to have a negative association with growth indicators and performance of players. Proper nutrition is very crucial for adolescent players, to address the body composition as well as to meet the demand for training and competition load. The players in the tribal area working hard to excel in sports, hence this issue of energy requirement and specifically protein intake were taken into cognizance.

Aim of the study:

- To investigate the effect of SS on anthropometric indicators, selected under study.

MATERIAL AND METHODS:

Selection of Subjects:

A total of 120 players from Khel Parisar Kanker (KPK) and SAI were selected for the study. Participants of both groups were divided into the Experimental group (N=30) EG and Control group (N=30) CG. Soy ladoos prepared from processed soy flour, besan (Bengal gram flour), sugar, almond, cashewnut and ghee were consumed by the experimental group. They consume 50 grams per day which have 10.3gram protein. CG did not consume Soy ladoo. The experimental protocol was approved by the ethical committee (246/IEC/PRSU/2018). All the subjects were trained according to their sports for 4 hours along with their academic engagements. Before testing the written consent form was taken regarding the willingness of participation in the study.

Selection of variables:

Mid upper arm circumference (MUAC), Waist girth (WG) and Body mass index (BMI) are used to identify the status of muscle development, the proportion of abdominal fat and body composition. Height, Weight, MUAC, Waist Girth (WG)was measured with standard techniques and BMI was calculated.

Experimental design:

Experimental design before and after with control group was used. The variables were measured in the beginning and after every three months for the experimental group and control group till 9 months after the supplementation. Data collected was analysed through SPSS package 25 version.

RESULTS:

Table 1. Descriptive statistics of the effect of soy supplement on MUAC, WG and BMI between KPK and SAI girls.

		KPK GIRLS N=30		SAI GIRLS N=30	
MUAC	**MEASURES**	**PRE-TEST**	**POST-TEST**	**PRE-TEST**	**POST-TEST**
EXPERIMENTAL GROUP	**MEAN**	**7.87±10**	**8.98+-.14**	**8.59+-.17**	**9.95+-.21**
	SD	**.59**	**.77**	**.93**	**1.18**
CONTROL GROUP	**MEAN**	**9.01+-17**	**8.85+-.19**	**10.07+-.21**	**9.33+-.17**
	SD	**.95**	**1.04**	**1.17**	**.95**
WG EXPERIMENTAL GROUP	**MEAN**	**23.74+-.32**	**26.91+-.33**	**26.36+-.38**	**28.11+-.40**
	SD	**1.76**	**1.83**	**2.12**	**2.20**
CONTROL GROUP	**MEAN**	**27.30+-.40**	**26.38+-.47**	**29.17+-.38**	**28.06+-.52**
	SD	**2.21**	**2.57**	**2.09**	**2.87**
BMI EXPERIMENTAL GROUP	**MEAN**	**18.48+-.31**	**0+-.27**	**20.40+-.50**	**20.79+-.37**
	SD	**1.72**	**1.48**	**2.74**	**2.03**

CONTROL GROUP	**MEAN**	**18.70+-37**	**18.18+-.40**	**20.78+-.46**	**20.23+-.37**
	SD	**2.06**	**2.20**	**2.52**	**2.07**

Table 1 shows the mean course of MUAC, WG, BMI before and after the soy supplement. Mean score gain in the experimental group of KPK girls and SAI girls in MUAC is 1.11 inches and 1.36 inches, in WG is 3.17 inches and 1.75 inches and in BMI is 1.32 to and 0.39 respectively whereas control groups of KPK and SAI did not show any change in any of the variable selected.

Table 2. Analysis of covariance and comparison of adjusted post-test means of soy supplement on MUAC, WG and BMI between EG and CG of KPK and SAI girls.

MUAC	SUM OF SQUARES	DF	MEAN SQUARE	F	SIG	PARTIAL ETA SQUARED
Contrast	**33.208**	**3**	**11.069**	**15.09**	**.000**	**0.283**
Error	**84.335**	**115**	**0.733**	**-**	**-**	**-**
WG						
Contrast	**127.127**	**3**	**42.376**	**11.10**	**.000**	**0.225**
Error	**438.827**	**115**	**3.816**		**-**	**-**
BMI						
Contrast	**57.740**	**3**	**19.247**	**11.51**	**.000**	**0.231**
Error	**192.203**	**115**	**1.371**		**-**	**-**

Table 2reported a significant difference in adjusted post-test mean scores of MUAC between EG and CG (F (3,115) = 15.09, p <0.00). Lower effect (.283) after soy supplement was seen when compared with Cohen's guidelines of effect size (0.2- small effect 0.5- moderate effect, 0.8-large effect). The partial eta squared value of .283 justifies 28.3% effect of soy supplement (Independent variable) on MUAC (Dependent variable) in EG.

The significant difference in the adjusted mean score of WG was also reported between EG and CG (F (3,115) = 11.10, p<0.00). Small effect (.225) after the soy supplementation was seen when compared with Cohen's guidelines of effect size. The partial eta squared justifies 22.5% effect of soy supplement on WG in EG.

Similarly, the significant difference in adjusted post-test mean score of BMI between EG and CG (F (3,115) = 11.51, P< 0.00). Small effect (0.231) after the soy supplementation was seen when compared with Cohen's guidelines of effect size. The partial etas squared justifies 23.1% effect of soy supplement on BMI in EG.

Table 3. Trend analysis of the effect of soy supplement on MUAC, WG and BMI of KPK and SAI girls.

Measures	Source of Variation	Type III sum of squares	Df	Mean Square	F – ratio	Sig.
MUAC	**Intercept**	**38952.033**	**1**	**38952.033**	**14663.240**	**.000**
	Group	**100.185**	**3**	**33.395**	**12.571**	**.000**
	Error	**308.174**	**116**	**2.656**		
WG	**Intercept**	**345210.951**	**1**	**345210.951**	**24480.473**	**.000**
	Group	**761.065**	**3**	**253.688**	**17.990**	**.000**
	Error	**1635.772**	**116**	**14.101**		
BMI	**Intercept**	**185369.123**	**1**	**185369.123**	**11984.725**	**.000**
	Group	**367.275**	**3**	**122.425**	**7.915**	**.000**
	Error	**1794.185**	**116**	**15.467**		

Table 3 reported statistically significant improvement in trend on MUAC after Soy Supplement (F (1,116) = 14663.24, p<.000) at 1% level of significance. It also shows the statistically significant difference in comparing the trend of MUAC between KPK and SAI girls (F (3,116) = 12.57, p<.000) at 1% level of significance.

Similar improvement in trend on WG was seen (F (1,116) = 2448 0.47, p<.000) at 1% level of significance after soy supplement. It also shows the statistically significant difference in comparing the trend of WG between KPK and SAI girls (F (3,116) = 12.57, p<.000) at 1% level of significance.

Likewise, improvement in trend on BMI was seen (F (1,116) = 11984.72, P<.000) at 1% level of significance after soy supplement. The trend on BMI between KPK and SAI girls (F (3,116)= 7.91 P<.000) at 1% level of significance shows a statistically significant difference.

Table 4.Trendanalysisofthe effect of soy supplement on MUAC, WG AND BMI among KPK and SAI girls.

Source	Factor 1	Type III sum of squares	Df	Mean Square	F-ratio	Sig.
MUAC	**Linear**	**13.054**	**1**	**13.054**	**27.87**	**.000**
	Factor*Group Linear	**46.723**	**3**	**15.574**	**33.256**	**.000**
	Error(factor1)	**54.324**	**116**	**0.468**		
WG	**Linear**	**40.119**	**1**	**40.119**	**17.69**	**.000**
	Factor*Group Linear	**196.439**	**3**	**65.480**	**28.872**	**.000**
	Error(factor1)	**263.079**	**116**	**2.268**		
BMI	**Linear**	**1.034**	**1**	**1.034**	**0.793**	**.375**
	Factor*Group Linear	**36.832**	**3**	**12.277**	**9.417**	**.000**
	Error(factor1)	**151.242**	**116**	**1.304**		

Table 4 supports Linear trend F (1,116) =27.87,p< .000, between independent variable (soy supplement) and dependent variable (MUAC) for EG. It also showed a statistically significant difference in linear trend F (3,116) =33.25, p< .000, between KPK and SAI female players.

Similarly, the table supports the linear trend F (1,116) =17.69, p<.000, between the independent variable (soy supplement)and dependent variable (WG) for EG. It also showed a statistically significant difference in linear trend F (3,116) = 28.87 p< .000 between both the groups.

In case of the linear trend F (1,116) = .793, p< 0.05, did not support between the independent variable (soy supplement) and dependent variable (BMI) for EG whereas it showed a statistically significant difference in the linear trend F (3,116) = 9.41, p< .000 on BMI between the KPK and SAI players.

DISCUSSION:

Anthropometric measurements are important indicators of growth and optimal growth can contribute to better performance. MUCA, WG and 8 BMI showed significant improvement in EG of KPK and SAI female players which can be considered as a factor for performance

improvement. A large number of studies indicates that players need to ingest protein two times of RDA (1.5 to 2.0 kg/d) to maintain protein balance.[17,18,19,20] An overview that soy being a dense source of protein with all essential amino acid helps to attain protein requirements before, during and after exercise.[21]Studies have shown that soy protein contributes to optimising muscle performance during and after exercise[22] and promotes lean body mass gain.[23,24,25,26]Munson States 20 to 25 gram of protein every 3 hours is needed to maintain muscle protein synthesis.[27]Low protein consumption (0.86kg $^{-1}$day^{-1}) by strength-trained athletes results in reduced protein synthesis compared with medium and high 1.4g kg^{-1} day^{-1} and 2.4g.kg^{-1} day^{-1} protein diets respectively.[28] Soy has antioxidant properties and similar digestibility and absorption properties like animal protein, so it is good for vegans. Thus, soy supplement is implemented to the sportsperson.

CONCLUSIONS AND RECOMMENDATIONS:

MUAC, WG and BMI are the important anthropometric indicators and significant improvement have been observed in these indicators after nine months of soy supplementation in the diet of the experimental groups. Soy supplement can be included in the diet of adolescent female players to improve body composition, which may in turn be helpful in better performance.

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Competing Interest:

Authors acknowledge that no competing interest exists.

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