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Influence of Bovine Colostrum and Weight Training on Bone Mineral Density and Muscular Strength and Shooting Accuracy for Soccer Junior

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Abstract: The purpose of this study was to determine the effect of 12 wk of bovine colostrum (BC) and weight training (WT) on the density and content of bone mineral (BMD) (BMC), muscular strength (MS) and shooting accuracy (SA) for soccer juniors. Twenty male soccer juniors were randomly divided into two experimental groups each one 10 soccer juniors, 1, BC group without training, 2 BC+WT group and required to consume either 40 g/d BC powder for 12 week. Two measures were used to assess performance before (pre)and after (post) a 12-wk training period. Researchers has tended to use BC and BC+WT program to identify their impact on the BMD,BMC, MA and SA for soccer juniors.BMD and BMC was assessed via dual x-ray absorptiometry The experimental method was applied on a subject of 20 soccer juniors in Sharkia club in Egypt, their ages under 12 years old. One of the most important results of this research was a significant difference among BC and BC+WT groups in BMD Femoral neck (g/cm2), BMD torch (g/cm2), BMC Femoral neck (g), BMC Troche (g), BMD spine (L2- L4) (g/cm2) and (BMC) spine (L2-L4) (g), in leg press, Bench press, Leg curl, Leg extension, Over head press, Press behind neck, Abdomen muscle, Vertical jump and SA for BC+WT group in the post measurements . Also, there is a higher enhancement in the post measurement of BC+WT group than the BC group. Also, there is an enhancement of the BMD Femoral neck (g/cm2), BMD torch (g/cm2), BMC Femoral neck (g), BMC Troche (g), BMD spine(L2- L4) (g/cm2) and BMC spine(L2- L4) (g) (15.79%, 16.47%, 19.87%, 17.06%, 15.45%,27.06%) consequently, MS in leg press, Bench press, Leg curl, Leg extension, Over head press, Press behind neck, Abdomen muscle, Vertical jump and SA (48.54%, 35.77%, 56.55%, 40.46%, 55.25%, 56.03%, 35.79%, 37.01%, 62.23%) consequently for the post one for soccer juniors .

Key words: Bovine colostrum · Weight training · Muscular Strength · Bone mineral content · Shooting accuracy

INTRODUCTION

Bovine colostrum (BC) is the initial milk secreted by cows during the first days postpartum and contains significant quantities of biologically active molecules [1]. BC contains growth factor and many bioactive substances needed for body to combat with wear and tear. BC contains around 90 useful components. The two primary components are immune factors and growth factors, In addition to this colostrum also contains vitamins, minerals, amino acids, proteins, fats and carbohydrates for the new born [2]. Many studies have led to suggest that BC may enhance training adaptations and subsequent physical performance [3]. Soccer junior needs that provide the potential physical, morphological and skilful the requirements of the soccer sport. Strength training is a common component of sports and physical fitness programs for young people. Some adolescents and players may use strength training as a means to enhance muscle size and definition or to simply improve appearance. Strength training programs may include the use of free weights, weight machines, elastic tubing, or body weight. The amount and form of resistance used as well as the frequency of resistance exercises are determined by specific program goals [4]. Weight training (WT) has an important role in most sports activities because of their significant influence in the development of muscular ability of the players [5]. WT has benefits

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including increasing the muscular strength (MS) of players and enhancement in a player's muscular endurance, body including increasing the (MS) of players and improvements in a player's muscular endurance, body composition and sports performance [6]. MS is very important to perform skills and tactic in soccer sport especially for shooting accuracy (SA) Where shooting is a basic skill is to score goals in soccer sport which needs to provide the components of fitness and most important of MS, which require the availability of density of bone mineral (BMD) and bone mineral content (BMC) is good for building a strong skeleton. BMD measurements are widely used to diagnose osteoporosis and measurements in bone mass are commonly used as a surrogate for fracture risk. BMD is the measured parameter and allows the calculation of the bone mineral content (BMC) in grams [7]. Some studies has been reported that exercise training enhance bone formation in humans [8]. During childhood, BMD increases until peak bone mass is reached. Peak bone mass and subsequent bone losses are important determinants of osteoporosis later in life [9]. It is essential to know which factors influence BMD in childhood. The risk of osteoporosis fractures in elderly increases progressively as BMD declines and reduction of 1 standard deviation 1SD in the BMD of the femoral neck is associated with a doubling of the risk of hip fractures [10].There are several reasons to suggest that the pre-pubertal years are the best stage of growth and when the skeleton is most responsive to exercise. One reason is that the pre-pubertal growth is relatively sex hormones independent. Another reason is that, in a study by Bass *et al*. [11], the residual benefits of exercise before puberty and maintained into adulthood has been illustrated. Only a few human studies of (BC) ingestion have reported whether adverse effects were observed. None of the sports performance related studies reported any adverse effects of supplementation of up to 9 weeks with 60 /g day of colostrums in adults and tow studies with children no adverse effects were reported with daily doses of Bovine colostral whey (Freeze -dried product) of either 0.05 9 for tow months or 109 for 4 days [12] . Using BC and WT for young athletes in order to ensure an optimal physical level is important as grown up athletes are still under debate. Studies on the effect weight training with children maturation are complicated by the fact that the growth and maturation also influence on the BMC. WT exercises for soccer juniors and children have a great value to enhance the MS and protect them from osteoporosis and have a good relation to improve the sports performance for athletes [6]. Researchers noted by working in the field of soccer training for juniors lack of interest in trainers exercises (WT) inhalers scientifically for the preparation of an emerging soccer, leading to lack the muscle power to perform various skills in soccer, in addition to lack of interest in the great device for children in pre-adolescence, which requires a focus on the development of increased density and content of bone minerals, both in terms of training and healthy nutrition. The purpose of the present study was to throw the further light on the need for healthy nutrition and physical training at a young age of soccer juniors and examine the Influence of BC and BC+WT on BMD, BMC, MS and SA for soccer juniors .

MATERIALS AND METHODS

The Subject: The subject was twenty male soccer juniors divided to two experimental groups each one equal 10 juniors, BC group without training and BC+WT group ingested BC with WT training. Mean age of whole subject was11.16±0.23 years, weight was 37.04 ±2.98 kg, height was 148.35±1.16 cm and training experience was 2.75±0.32 years, volunteered to participate. The subjects were informed about the experimental procedures and signed informed consent statement and medical history forms in adherence with the human's guidelines of Zagazig University and Faculty of Physical Education for Boys before any data collection. None of the participants was known to have any illnesses or to take medication known to affect bone metabolism and structure. All juniors were members of El-Sharkia sports club in Egypt and participated in the local league within their age in the Egyptian national league. Subjects' descriptive characteristics are presented in Table 1.

There are no significant differences in the following variables (age, height, weight and Training experience) ($P < 0.05$) which indicates the harmony of sample's research as well as the possibility of conducting such an experiment in such a sample (Table 1).

This study has been conducted of three steps: (1) doing the pre- measurement on Saturday 31/3/2011 to Thursday 5/4/2011 by measuring height, weight, BMD (g/cm2) and BMC, MS and SA tests by using Dual Energy-x ray absorptiomtery (DEXA) (Norland 2000) to evaluate BMD (g/cm2) and BMC(g) of the lumbar spine (L2-L4) and femoral neck Based on adult scans the precision of the lumbar spine and femoral neck bone measurement was 99%. Standard positioning protocol and software were used to complete and analyze the scans; the inter-operator reliability and validity scans at site were

Table 1: Physical characteristics of the subject

Variable	Mean	SD	Median	Kurtosis	Skewness
Age(y)	11.16	0.23	11.20	0.52	0.87
Height(cm)	148.35	1.16	148.00	0.87	1.42
Weight(Kg)	37.04	2.98	37.00	0.96	0.39
Training experience(y)	2.75	0.32	2.68	0.33	0.09

• Mean ± SD standard deviation

Table 2: The descriptive characteristics and between BC and BC+WT groups

Variable	(BC)	(BC+WT)
Age(y)	11.11 ± 0.24	11.17 ± 0.30
Height(cm)	148.30 ± 1.25	148.40 ± 1.15
Weight(Kg)	37.20 ±3.03	37.25 ± 3.05
Training experience(y)	2.73± 0.35	2.77 ±0.32
Leg Press (Kg)	34.05 ± 0.89	34.01 ± 0.74
Bench press (Kg)	15.60 ± 0.70	15.80 ± 0.92
Leg curl (Kg)	11.05 ± 1.18	11.60 ± 1.51
Leg extension (Kg)	20.65 ± 0.95	20.78 ± 0.87
Over head press (Kg)	11.15 ±0.95	11.41 ± 1.29
Press behind neck (Kg)	11.37 ± 0.46	11.30 ± 0.72
Abdomen muscle(No)	22.80 ± 0.63	22.73 ± 0.93
Vertical jump(cm)	18.95 ±0.63	18.74 ± 0.48
Shooting accuracy(Deg)	5.00 ± 0.67	4.9 ± 0.57
BMD Femoral neck (g/cm2)	0.81 ± 0.01	0.80 ± 0.01
BMD Troch (g/cm2)	0.71 ± 0.01	0.71 ± 0.1
BMC Femoral neck (g)	3.66 ± 0.04	3.67 ± 0.04
BMC Troch (g)	4.52 ± 0.05	4.52 ±0.05
BMD spine(L2- L4) (g/cm2)	0.62 ± 0.20	0.62 ± 0.01
BMC spine(L2- L4) (g)	21.26 ±0.15	21.29 ± 0.09

*n=20 Bovine Colostrum group (BC) and Bovine colostrum plus weight training group (BC+WT).

Table 3: Reliability and Validity of the tests

	Test re- test		Validity of measurements	
Variable	Pre	Post	Pre - (S S)	Post - (S S)
Leg Press (Kg)	34.70± 0.95	35.80 ± 0.92	34.70± 0.95	45.01 ± 3.15
Bench press (Kg)	17.26 ± 3.07	17.72± 3.28	17.26 ± 3.07	25.53 ± 2.57
Leg curl (Kg)	12.59 ± 2.69	13.12 ± 2.71	12.59 ± 2.69	20.00 ± 1.33
Leg extension (Kg)	19.78 ± 1.34	20.50 ± 1.27	19.78 ± 1.34	26.10 ± 1.45
Over head press (Kg)	12.27 ±2.20	12.30 ±2.48	12.27 ±2.20	18.38 ± 2.86
Press behind neck (Kg)	11.96 ±1.39	12.75 ± 1.47	11.96 ±1.39	18.34 ± 0.47
Abdomen muscle(No)	22.80 ± 0.83	22.97 ± 0.46	22.80 ± 0.83	28.90 ± 1.45
Vertical jump(cm)	18.41 ± 1.09	18.65 ± 1.06	18.41 ± 1.09	23.65 ± .1.94
Shooting accuracy(Deg)	6.48 ± 1.05	6.62 ± 1.29	6.48 ± 1.05	9.40 ± 0.69
BMD Femoral neck (g/cm2)	0.80 ± 0.01	0.82 ± 0.01	0.80 ± 0.01	0.83 ± 0.01
BMD Troch (g/cm2)	0.69 ± 0.01	0.70 ± 0.01	0.69 ± 0.01	0.72 ± 0.01
BMC Femoral neck (g)	3.61 ± 0.01	3.62 ± 0.02	3.61 ± 0.01	3.76 ± 0.03
BMC Troch (g)	4.48 ± 0.02	4.49 ± 0.02	4.48 ± 0.02	4.57 ± 0.04
BMD spine(L2- L4) (g/cm2)	21.13 ± 0.32	21.15± 0.31	21.13 ± 0.32	22.10 ± 0.20
BMC spine(L2- L4) (g)	0.61 ± 0.01	0.62 ± 0.02	0.61 ± 0.01	0.67 ± 0.02

*n=10 special subject (S S)

collected during each data collection period (Table 3). Scans were performed at random between groups and repeated to asses the reliability, validity and quality of the measurement system, the subjects were ingested 40 g/day of BC powder (characteristics and composition of pure BC were 1st milking protein 55%, total immunoglobulins27%, fat21.8%, ash4.5%, lactose11.0-13.3%, moisture2.5-6% and pH6.3 %, consequently) for 12 week (20 g with the morning meal before the training and 20 g/day after the training). The 20 g/day of BC was added to 85 ml of water to each one of the BC and BC+WT groups. (2) Applying the training course for BC+WT group from Saturday 9-4-2011 to Saturday 2/6/2011, using WT program in this training course. (3) Third step: post- measurements on Sunday 3/6/2011 to Saturday 9/6/2011 are performed on all variables we already performed in pre- measurements. The content of the training course being used:

Duration of training course is 12 weeks and it consists of two period:

- Basic period continued 4 weeks aimed to Balanced development of both upper limb and lower limb and the creation of junior high - intensity performance.

- Exercises number is 12 exercises.
- Training intensity (50%: 60%) 50% from one-repetition maximum (1-RM) for upper limb and 40% (1MR) for lower limb.
- Training load 3 groups and repetition from (10-15).
- Rest 1-1.5 minutes

- Specific preparation period continued 4 weeks aimed to develop the muscle strength and increase muscle trophy for legs and arms.

- Exercises number is 12 exercises Appendix 1
- Training intensity (60%:70%) 60% from 1 maximum repetition(1MR)for upper limb and 50% (1MR)for lower limb
- Training load 4 groups and repetition from (8-10).
- Rest 1.5-2 minutes
- Three weekly training units

- Pre-Competition period continued 4 weeks aimed to develop the muscle ability and increase muscle trophy for legs and arms.

- Exercises number is 12 exercises.
- Training intensity (70%:80%) 60% from 75 %(1MR) for upper limb and 65% (1MR) for lower limb.
- Training load 3 groups and repetition from 6-8times.
- Rest 2-3 minutes

Weekly training units are three. There is warming-up before the beginning of every training unit. Slowdown, flexibility for all joints and stretching for the whole body muscles at the end of every training unit.

These results made clear that there are no significant differences between the groups of the research variables ($P < 0.05$), which stresses harmony of tests(Table 2).

These results made clear that there are significant correlation between the first and the second application of the test ($P < 0.05$), which stresses stability of tests. This indicates the reliability of the tests (Table 3).We find too there are significant differences between the two distinctive (Sharkia club under 12 years old) and non - distinctive groups ($P < 0.05$). This indicates the validity of tests under study (Table 3).

Statistical Analysis: Data analysis was performed using SPSS version 13.0.Where the researchers analyzed the results using the mean, Standard deviation, median, kurtosis, skewness, Person correlation, t.test.The level of significance was set at $p < 0.05$.

RESULTS AND DISCUSSION

The results indicate that there are no significant differences between pre and post- measurements in MS and SA tests in favour of post- measurement. Results have also showed there are an enhancement between pre-and post measurements in the all variables range between 1.76% and 15.53% (Table 4). However, the results showed that there are no significant differences between pre and post- measurements for the post one (Table 4). The results show also there are an enhancement and changes between the pre and post- measurements in leg press, bench press, leg curl, leg extension, over head press, press behind neck, abdomen muscle vertical jump and SA (2.74% 1.88%, 13.67%, 3.95%, 7.47%, 15.53%, 15.53%, 3.80%, 1.76%, 13.79%, consequently) for the post one. The researchers refer that to influence of the BC which led to an low enhancement of MS, in addition the BC group did not participate in an exercise training.

The results indicate that there are significant differences between pre - and post measurements in BMD and BMC in favour of post- measurement. Results have also showed there are an enhancement between pre - and post measurements in the all variables range between 1.16% and 12.67% (Table 5). Results show that there are

Table 4: Pre and post measurements of MS for BC group

Variable	Pre- measurements	Post-measurements	% Change
Leg Press (Kg)	34.05 ± 0.89	35.01 ± 0.87	2.74%
Bench press (Kg)	15.60 ± 0.70	15.90 ± 0.57	1.88%
Leg curl (Kg)	11.05 ± 1.18	12.80 ± 0.63	13.67%
Leg extension (Kg)	20.65 ± 0.95	21.50 ± 0.85	3.95%
Over head press (Kg)	11.15 ±0.95	12.05 ± 0.83	7.47%
Press behind neck (Kg)	11.37 ± 0.46	13.20 ± 0.79	15.53%
Abdomen muscle(No)	22.80 ±0.63	23.70 ± 0.48	3.80%
Vertical jump(cm)	18.95 ±0.63	19.29 ± 0.57	1.76%
Shooting accuracy(Deg)	5.00 ± 0.67	5.80 ± 0.42	13.79%

*n=10

Table 5: Pre and post- measurements of BMD and BMC for BC group

Variable	Pre- measurements	Post-measurements	% Change
BMD.Femoral neck (g/cm2)	0.81 ± 0.01	0.86 ± 0.01	1.16%
BMDTroch (g/cm2)	0.71 ± 0.01	0.75 ± 0.01	5.33%
BMC. Femoral neck (g)	3.66 ± 0.04	4.10 ± 0.03	10.73%
BMC.Troch (g)	4.52 ± 0.05	4.74 ± 0.01	4.64%
BMD spine(L2- L4) (g/cm2)	21.26 ±0.15	22.38 ± 0.34	5.00%
BMC spine(L2- L4) (g)	0.62 ± 0.20	0.71 ± 0.01	12.67%

*n=10

Table 6: Pre and post measurements of MS and SA for BC+WT group

Variable	Pre- measurements	Post-measurements	% Change
Leg Press (Kg)	34.01 ± 0.74	66.10 ± 2.08	48.54%
Bench press (Kg)	15.80 ± 0.92	24.60 ± 0.70	35.77%
Leg curl (Kg)	11.60 ± 1.51	26.70 ± 0.48	56.55%
Leg extension (Kg)	20.78 ± 0.87	34.90 ± 0.32	40.46%
Over head press (Kg)	11.41 ± 1.29	25.50 ± 0.53	55.25%
Press behind neck (Kg)	11.30 ± 0.72	25.70 ± 0.68	56.03%
Abdomen muscle(No)	22.73 ± 0.93	35.40 ± 0.52	35.79%
Vertical jump(cm)	18.74 ± 0.48	29.75 ± 0.43	37.01%
Shooting accuracy(Deg)	4.9 ± 0.57	13.01 ±0.32	62.23%

*n=10

Table 7: Pre and post measurements of BMD and BMC for BC+WT group

Variable	Pre-measurements	Post-measurements	% Change
BMD Femoral neck (g/cm^2)	0.80 ± 0.1	0.95 ± 0.01	15.79%
BMDTroch (g/cm^2)	0.71 ± 0.1	0.85 ± 0.01	16.47%
BMC Femoral neck (g)	3.67 ± 0.04	4.58 ± 0.09	19.87%
BMC Troch (g)	4.52 ±0.05	5.45 ± 0.03	17.06%
BMD spine(L2- L4)(g/cm^2)	21.29 ± 0.09	25.18 ± 0.14	15.45%
BMC spine(L2- L4) (g)	0.62 ± 0.01	0.85 ± 0.02	27.06%

*n=10

Table 8: The post measurements of MS and SA between BC and BC+WT groups

Variable	BC group	BC+WT group
Leg Press (Kg)	35.01 ± 0.87	66.10 ± 2.08
Bench press (Kg)	15.90 ± 0.57	24.60 ± 0.70
Leg curl (Kg)	12.80 ± 0.63	26.70 ± 0.48
Leg extension (Kg)	21.50 ± 0.85	34.90 ± 0.32
Over head press (Kg)	12.05 ± 0.83	25.50 ± 0.53
Press behind neck (Kg)	13.20 ± 0.79	25.70 ± 0.68
Abdomen muscle(No)	23.70 ± 0.48	35.40 ± 0.52
Vertical jump(cm)	19.29 ± 0.57	29.75 ± 0.43
Shooting accuracy(Deg)	5.80 ± 0.42	13.01 ±0.32

*n=20

Table 9: Post- measurements of BMD and BMC between BC and BC+WT groups

Variable	BC group	BC+WT group
BMD.Femoral neck (g/cm^2)	0.86 ± 0.01	0.95 ± 0.01
BMDTroch (g/cm^2)	0.75 ± 0.01	0.85 ± 0.01
BMC. Femoral neck (g)	4.10 ± 0.03	4.58 ± 0.09
BMC.Troch (g)	4.74 ± 0.01	5.45 ± 0.03
BMD spine(L2- L4) (g/cm^2)	22.38 ± 0.34	25.18 ± 0.14
BMC spine(L2- L4) (g)	0.71 ± 0.01	0.85 ± 0.02

*n=20

significant differences among pre-and post measurements in BMD and BMC tests for the post one (Table 4). The results show also there are an enhancement and changes between the pre- and post measurements in BMD Femoral neck (g/cm2), BMD torch (g/cm2), BMC Femoral neck (g), BMC Troche (g), BMD) spine(L2- L4) (g/cm2) and BMC spine (L2-L4) (g) (1.16% 5.33%, 10.73%, 4.46%, 5.00%, 12.67%, consequently) for the post one. The researchers refer that to influence of the BC which led to an enhancement in BMD and BMC in favour of post- measurement, because it contains a rich source of essential nutrients and biologically active components such as antimicrobial molecules, hormones and peptide growth factors, including insulin-like growth factor-1 (IGF-1) and epidermal growth factor (EGF) [13]. Whereas dietary BC has been shown to increase circulating insulin-like growth factor I (IGF-I) concentrations and skeletal muscle protein synthesis [14]

The results indicate that there are significant differences between pre - and post measurements in MS and SA tests in favour of post- measurement. Results have also showed there is an enhancement between pre and post -measurements in the all variables range between 35.77% and 62.23% for the post one (Table 6). The results show also there are an enhancement and changes between the pre- and post measurements in leg press, Bench press, Leg curl, Leg extension, Over head press, Press behind neck, Abdomen muscle, Vertical jump and SA (48.54%, 35.77%, 56.55%, 40.46%, 55.25 %, 56.03%, 35.79%, 37.01%, 62.23%,) consequently for the post one. The negligible change in MS variables and SA in our study could be due to the influence of WT program which led to an enhancement of MS and SA measurements. This refers that WT exercises led to improving the efficiency nervous system ability in increasing the harmony of muscular group and muscular work between upper and lower limbs muscles. In addition to BC has been shown to increase circulating IGF-I concentrations and skeletal muscle protein synthesis in newborn [14]. More recently, supplementation with BC has also been shown to increase serum IGF-I concentrations in adult humans [15].

The results indicate that there are significant differences between pre - and post measurements in BMD and BMC in favour of post- measurement. Results have also showed there are an enhancement between pre - and post measurements in the all variables range between 15.45% and 27.06% (Table 7). The results show also there are an enhancement and changes between the pre- and post measurements in BMD Femoral neck (g/cm^2), BMD torch (g/cm^2), BMC Femoral neck (g), BMC Troche (g), BMD spine (L2- L4) (g/cm^2) and BMC spine(L2- L4) (g) (15.79%, 16.47%, 19.87%, 17.06%, 15.45%,27.06%, consequently) for the post one. We refer that to influence of the optimal dose of exercise (intensity, frequency, rate of progression and duration) of WT and oral supplementation of BC which led to an enhancement in BMD and BMC in favor of post- measurement, a combination of BC and WT were more effective and that is very clear in percentage ratio than the BC group. Smeets *et al.* [15] reported that BC increased IGF-1 concentrations in nine male sprinters. However, these investigators did not assess body composition changes to determine if the measured increase in IGF-1 can produce subsequent gains in lean body mass. BC supplementation has been shown to enhance also an ability to repeat sprints in elite field hockey players. [16].

The results indicate that there are significant differences between BC and BC+WT groups in the post measurements in MS and SA tests in favour of post-measurement in the all variables for BC+WT group. The researchers refer that to influence of the combination of BC+WT program which led to an enhancement of MS and SA measurements. In addition to WT exercises led to improving the nervous system ability in increasing the harmony of muscular work between upper and lower limbs muscles. And this matches with what mentioned that soccer player mostly needs during motor performance in matches, to considerable harmony between body's parts during performance. And this correlated with muscle tone or muscles tension which suits the nature of target performance. Also, reflexes help achieving the required balance between stimulation and refraining processes

within working muscles set inside motor performance and that is called motor harmony [17]. In addition to the WT exercises create greater forces on bones which as a consequence have to adapt their strength to keep strains within the threshold range of modelling and remodelling. Therefore, increased loading stimulates bone modelling which results in changes in cortical bone shape and increased trabecular BMD which in turn causes increased bone strength [18]. In addition to We refer that to influence of the optimal dose of exercise(intensity, frequency, rate of progression and duration) of WT which led to an enhancement in BMD and BMC in favour of post- measurement, needed to enhance bone strength in soccer juniors

The results indicate that there are significant differences between BC and BC+WT groups in the post measurements in BMD and BMC tests in favour of post-measurement in the all variables for the BC+WT group, which were significantly higher ($p<0.05$) than that in WC group . The researchers refer that to influence of the combination of BC+WT program which led to an enhancement of MS and SA measurements. The researchers concluded that BC+WT improved BMD, BMC, MS and SA higher than the BC group. This performance enhancement is supported by the study of Coombes *et al.* [19] where an 8-week BC supplementation provided a significant improvement in time trail performance in cyclists after a 2-h ride at 65% VO2 max. In this study we present the results of the combined effects. Detecting interaction was a primary goal of this study. We expected the greater increase in BMD and BMC in the BC+WT group after the 12 week compared to BC group, low baseline levels of exercise and dietary BC were likely to cause the desired effect in skeletal benefits. The WT which was developed for this investigation was simple and appropriate for juniors' level. The results show that 40 g/day of BC daily and WT exercise three times per week can increase BMD at loaded skeletal sites. While the importance of exercise relates to changing bone size and shape, we can conclude that in this group that BC+WT have a synergistic effect on bone. This caused an enhancement greater increase in BMD, BMC, MS and SA than the BC group at the spine and femoral neck. While BC+WT were both beneficial for enhancing, MS and SA, their combination was more osteogenic at the femur than either of them alone. Nonetheless, our research like prior studies [20, 21] was more inclined to effectiveness of exercise. These results help to provide more evidence for public health organizations and soccer trainers to deal with both exercise and nutrition issues in juniors and children for the achievement of peak BMD, BMC, MS and SA for soccer juniors.

CONCLUSION

- Regular use of BC has no effect on MS and SA for soccer juniors but it leads to an enhancement in BMD Femoral neck (g/cm^2), BMD torch (g/cm^2), BMC Femoral neck (g), (BMC) Troche (g), (BMD) spine(L2-L4) (g/cm^2) and (BMC) spine(L2-L4) (g) (1.16% 5.33%, 10.73%, 4.46%, 5.00%,12.67%, consequently).
- Regular use of BC+WT lead to an enhancement in leg press, bench press, leg curl, leg extension, over head press, press behind neck, abdomen muscle, vertical jump and SA(48.54%, 35.77%, 56.55%, 40.46%, 55.25%, 56.03%, 35.79%, 37.01%, 62.23%, consequently) and BC+WT exercises lead to an enhancement in BMD Femoral neck (g/cm^2), BMD torch (g/cm^2), BMC Femoral neck (g), BMC Troche (g), BMD spine (L2- L4) (g/cm2) and BMC spine (L2-L4) (g) (15.79%, 16.47%, 19.87%, 17.06%, 15.45%, 27.06%, consequently).
- The researchers concluded that using BC+WT for 12 weeks improves BMD,BMC,MS and SA higher than the BC group for soccer juniors under 12 years old.

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