



Effects of replacing dietary maize grains with increasing levels of sugar beet pulp on rumen fermentation constituents and performance of growing buffalo calves

H.M. Abo-Zeid^a, H.M. El-Zaiat^{a,*}, A.S. Morsy^b, M.F.A. Attia^a, M.A. Abaza^a, S.M.A. Sallam^a

^a Animal Production Department, Faculty of Agriculture, Alexandria University, Alexandria, Egypt

^b Livestock Research Department, Arid Lands Cultivation Research Institute, City of Scientific Research and Technological Applications, New Borg El-Arab, Alexandria, Egypt

ARTICLE INFO

Keywords:

Digestibility
Egyptian buffalo
Growth performance
Maize
Rumen characteristics
Sugar beet pulp

ABSTRACT

This study was conducted to evaluate the effects of replacing cracked maize with increasing levels of sugar beet pulp (SBP) on nutrients digestibility, blood biochemical and rumen fermentation constituents and animal performance of growing Egyptian buffalo calves. Forty male Egyptian buffalo calves (237.2 ± 24.46 kg of initial body weight, IBW) were allocated into a completely randomized design and stratified to one of four experimental diets. The basal diet was isonitrogenous (40:60 forage: concentrate) and was formulated to contain 60% of dietary DM cracked maize replaced by ascending levels of SBP (0, 333, 667, and 1000 g/kg respectively). The study lasted for a period of 143 days from which 21 days for adaptation while the remaining 122 days were used for data collection. Increasing the level of SBP resulted in a quadratic increase ($P = 0.017$) in the average daily gain (ADG) with a linear tendency of increase ($P = 0.064$) in dietary dry matter intake. A quadratic decrease of feed conversion ratio (FCR, $P = 0.005$) was observed with the ascending levels of SBP. In addition, the daily intake of organic matter, neutral detergent fiber assayed with heat stable α -amylase and corrected for ash (aNDFom), acid detergent fiber corrected for ash (ADFom) were quadratically ($P < 0.01$) improved upon increasing the dietary SBP level while the daily intake and digestibility of ether extract were declined linearly ($P < 0.01$). Replacing SBP for maize resulted in linear increase ($P < 0.01$) in OM, aNDFom, cellulose and hemicellulose digestibility coefficients. Ruminal pH, total short chain fatty acids, proportions of acetate (C2) and butyrate were increased linearly ($P < 0.05$). In contrast, the proportions of propionate (C3) and isobutyrate were decreased linearly ($P < 0.05$) upon increasing the levels of SBP. In addition, the C2:C3 ratio and total protozoa were linearly ($P < 0.01$) increased while the ruminal $\text{NH}_3\text{-N}$ concentration was quadratically ($P = 0.046$) increased as SBP replaced maize in the diet. Furthermore, upon increasing the dietary SBP levels, the blood urea-N, cortisol and thyroxine (T4) concentrations were quadratically elevated ($P < 0.01$). Conversely, linear decreases in creatinine, ($P = 0.027$) and

Abbreviations: ADFom, acid detergent fiber expressed exclusive of residual ash; aNDFom, neutral detergent fiber expressed exclusive of residual ash; ADG, average daily gain; AOAC, association of official analytical chemists; BWG, body weight gain; BUN, blood urea-N; CP, crude protein; C2:C3, acetate to propionate ratio; DM, dry matter; DMI, dry matter intake; EGP, Egyptian pound; FBW, final body weight; FCR, feed conversion ratio; GC, gas chromatography; IBW, initial body weight; Lignin(sa), lignin measured by solubilization of cellulose with sulphuric acid; ME, metabolic energy; MPBW, market price of body weight; MPF, market price of feeds; MT, million ton; NEm, net energy for maintenance; NEg, net energy for gain; OM, organic matter; SBP, sugar beet pulp; SCFA, short chain fatty acids; T3, triiodothyronine; T4, thyroxine; TMR, total mixed ration

* Corresponding author at: University of Alexandria, Faculty of Agriculture, Department of Animal Production, Aflaton St., El-Shatby, P.O. Box 21545, Alexandria, Egypt.

E-mail addresses: hm_elzaiat@yahoo.com, hani.elzaiat@alexu.edu.eg (H.M. El-Zaiat).

<http://dx.doi.org/10.1016/j.anifeedsci.2017.09.011>

Received 17 February 2017; Received in revised form 14 September 2017; Accepted 15 September 2017

0377-8401/© 2017 Elsevier B.V. All rights reserved.

cholesterol ($P = 0.001$) concentrations were found. In addition, blood insulin like growth factor-1 (IGF-1) concentration increased linearly ($P = 0.006$) as SBP level increased. Feeding cost based on BW gain was linearly reduced ($P = 0.043$) by 25%, causing the overall profits (\$/head/d) to be quadratically ($P < 0.01$) increased. Overall, the obtained results indicate that replacing maize grains with up to 667 g SBP/kg diet resulted in a highest profit by 21%, enhanced ruminal fermentation, nutrients digestibility and ADG and reduced FCR. Therefore, this study could be economically feasible for use in fattening diets of growing Egyptian buffalo calves without impairing animal performance or health.

1. Introduction

Shortage of animal feeds is a major challenge for livestock sustainability and development worldwide. The use of cereal grains in ruminant diets is considered as a direct competitive conflict between livestock production and human nutritional systems. While the instability of livestock feed prices has forced beef producers to seek for alternative feed resources based on replacing maize grains without sacrificing feed quality or animal performance. Furthermore, due to the global demand for ethanol, the availability of maize grains may be diminished which could lead to inflation in maize prices. Meanwhile, consequences feeding of high-grain diets involve risks of low ruminal pH and rumen acidosis (Enemark et al., 2002).

In Egypt, approximately 11.33 million ton (MT) of sugar beet and 0.56 MT of sugar beet pulp (SBP), a by-product of sugar manufacture, are produced annually (FAO, 2016). Dried SBP contains 400 g/kg of digestible neutral detergent fiber (NDF) fraction, identified as rich readily fermentable fiber fraction (pectic substances) compared to forage NDF. This makes SBP a good alternative source for energy in maize-based diets (Mojtahedi and Danesh Mesgaran, 2011) and fibres (Nikkhah, 2015) for ruminants. Pectins are degraded faster than forage NDF and produce less propionate and lactate than starch without adverse effects on cellulose and hemicellulose digestibility (Marounek et al., 1985). Further, utilization of SBP in ruminant diets reduces the risk of rumen acidosis and digestive disorders resulted from excessive starch and unfavorable pH declines (Flachowsky et al., 1993). In addition, apparent digestibility of DM increased in Ossimi sheep diet (Omer et al., 2012) as a consequences of elevated digestion rate of starch with the fiber fraction of SBP (Evans and Messerschmidt, 2017). Moreover, Munnich et al. (2017) have found that a positive effect of SBP on ruminal pH was observed upon inclusion of SBP at 200 g/kg DM in the sheep diet.

To our knowledge, partial replacement of grains with SBP in diets was investigated (Mojtahedi and Danesh Mesgaran, 2011; Omer et al., 2012; Alamouti et al., 2014) while studies for total grains replacement with SBP in growing male buffalo calves diets are limited. SBP is considered as a distinctive nutritional and economical candidate for replacing grains in animal diets (El-Badawi et al., 2003). Therefore, the objectives of this study were to evaluate the effects of replacing cracked maize with SBP on DMI, ADG, nutrients digestibility, rumen fermentation constituents and economic return margins for growing male Egyptian buffalo calves.

We hypothesized that total replacement of maize grains with dried SBP as an alternative energy source in growing male buffalo diets has no adverse effects on animal health and performance and may have positive economic impacts on reducing feed costs.

2. Materials and methods

This study was carried out at the United Animal Production (a private Farm, El-Amreya district, south west of Alexandria, Egypt (31° 06_57_42 N 29° 47_51_35 E)). Animal care and procedures were conducted under established approved standards of the Animal Production Department, Faculty of Agriculture, Alexandria University, Egypt. All samples were analysed at the Laboratory of Animal Nutrition, Department of Animal Production, Faculty of Agriculture, Alexandria University.

2.1. Animals and housing

Forty male Egyptian buffalo calves with an average initial body weight (IBW) of 237.2 ± 24.46 kg, and age between 12 and 14 months at the commencement of the study were allocated to 1 of 4 semi-opened pens ($6 \times 10 \text{ m}^2$) with muddy floors bedded with rice straw (10 animals per pen). Pens were equipped with separate feeders for each animal and water buckets were always accessible. Animals were injected subcutaneously against internal and external parasites at the beginning of the experiment with American Ivomec super (Ivomec, Merial Inc., Duluth, GA, USA).

2.2. Experimental design and treatments

The experiment lasted for 143 days, of which 21 days for diet and treatment adaptation while the rest period (122 days) was used for sampling and data collection. Animals were allocated to pens according to a completely randomized design (CRD) and stratified to IBW and age. Each pen received 1 of 4 experimental diets formulated to comprise similar concentrations of nutrients including nitrogenous. The basal diet (40:60 forage: concentrate) was formulated to meet the growth rate requirements of 1 kg of daily gain of beef cattle according to NRC (1996). Dietary treatments consisted of four replacement levels of cracked maize by SBP, 0, 333, 667, and 1000 g/kg of the original maize concentration on DM basis (Table 1) were prepared. After the adaptation period, animals were offered equal portions of TMR three times daily at 07:00, 13:00 and 17:00 h.

Download English Version:

<https://daneshyari.com/en/article/5538715>

Download Persian Version:

<https://daneshyari.com/article/5538715>

[Daneshyari.com](https://daneshyari.com)